- Primary and Secondary Emergency Venting
- Manhole/Spillbox Combination for Filling, Dipping and Primary Tank Access. Manhole/Spillbox has: Large 72 Litre Capacity, 3/4" Drain Back Port, 2" Dip Port, Lockable Cover, Stainless Steel Hinge
- Two 4" N.P.T. Couplings c/w M.I. Plugs
- Containment Inspection Port
- Approved Lift Lugs
- Identification Name Plate
- Structural Saddle Base Support
- Grounding Lug
- Gauge Stick and Dip Chart
- Installation and Maintenance Manual

Specifications

Primary
ULC-S601-93 / UL-142

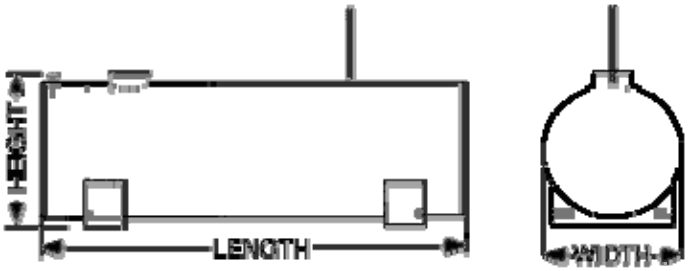
Fittings
Class #150

Secondary
ULC-S653-94 / UL-142 / UL-2044

Blast
SSPC-SP6

Pipe
Schedule 40 A53 GR.B

Coatings
Top Coat: High Build (Urethane)



Size (Liters)	Overall Dimensions			95% Fill Capacity	Approximate Tank Weight
	H	W	L		
1,364	44"	39"	89"	1,296	674 lbs.
2,400	51"	60"	87"	2,280	1,453 lbs.
4,328	51"	64"	145"	4,112	2,100 lbs.
10,000	77"	66"	214"	9,500	5,200 lbs.
15,000	95"	81"	217"	14,250	7,400 lbs.
25,000	102"	90"	290"	23,750	10,100 lbs.
35,000	102"	90"	395"	33,250	12,900 lbs.
50,000	131"	119"	323"	47,500	20,400 lbs.
61,000	131"	119"	385"	57,950	23,700 lbs.

75,000	131"	119"	461"	71,250	27,600 lbs.
90,000	131"	119"	545"	85,500	33,000 lbs.
100,000	126"	138"	552"	95,000	32,318 lbs.
120,000	139"	151"	552"	114,000	40,522 lbs.

SECTION 9.1 HEATING, VENTILATION & AIR CONDITIONING

Section 9.1 Heating, Ventilation & Air Conditioning

9.1.10 Fuel Tank Level Switch

Model # LS-800

Tag # NA

Series LS-800, LS-800 Adjustable Multi-Station Level Switches

(Includes LS-800's with Temperature Sensors)

Integrated Temperature Sensors Options

1. Thermistor for Continuous Indication
   - Excellent Repeatability

   Value: 10,000 ohms @ 77°F (25°C)

   Tolerance: ±0.2°C from 32°F to 158°F (0°C to 70°C)

   Operating Temperature: 302°F (150°C), Max.

   Alpha @ 25°C: -4.39%/°C

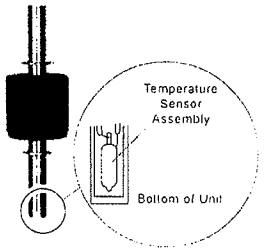
   Dissipation Constant: 1mW/°C in Still Air

   8 mW/°C in Oil Bath

2. Thermostat for Switch Action
   - Settings from 150°F to 175°F
   - Open or close switch on increasing temperature

Note

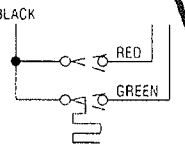
Contact Gems Sensors for Additional Information.



Note

End of unit stem must be submerged a minimum of 2-3/4" for level switch actuation.

Typical Wiring Diagram



PLEASE REVIEW AND COMMENT
DO NOT PROCEED WITH ANY WORK UNTIL RECEIVED
ACCORDING TO THE GENERAL CONDITIONS OF THE CONTRACT AND SUBJECT TO THESE
MAKE NOTED CORRECTIONS
REVISE & RESUBMIT
DATE: July 22, 2010 BY: K-B.

Return Policy

Returns are accepted on stock items up to 30 days from date of order. You must contact our Returns Department for a Return Authorization (RA) number. Return the goods - freight prepaid - in the original container and include original packing slip. C. O. D. returns are not accepted. Gems reserves the right to apply restocking charges.

Tel: 860-793-4357
Fax: 860-793-4563

Important Points:

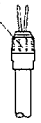
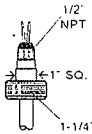
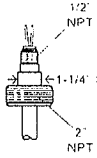
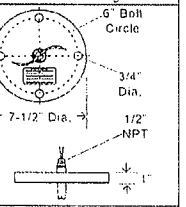
- Gems products must be maintained and installed in strict accordance with the National Electrical Code and the applicable Gems product instruction Bulletin that covers installation, operation and proper maintenance. Failure to observe this information may result in serious injury or damages.
- For hazardous area applications involving such things as, but not limited to, ignitable mixtures, combustible dust and flammable materials, use an appropriate explosionproof enclosure or intrinsically safe interface device.
- *** Warning: To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.
- Please adhere to the pressure and temperature limitations shown throughout this catalog for our level and flow sensors. These limitations must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of Gems products. Take care in the proper selection of materials of construction, testing is required.
- NSF-approved sensors are made of materials approved for potable water applications according to Standard 61.
- Stainless steel is generally regarded as safe by NSF and FDA.
- Life expectancy of switch contacts varies with application. Contact Gems if life cycle testing is required.
- Ambient temperature changes do affect switch set points, since the gravity of a liquid can vary with temperature.
- Our sensors have been designed to resist shock and vibration. However, shock and vibration should be minimized.
- Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.
- Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.
- Our sensors must not be field-repaired.
- Physical damage sustained by product may render it unserviceable.

Gems Sensors Inc.
One Cowles Road
Plainville, CT 06062-1198
Toll-Free: 1-800-378-1600

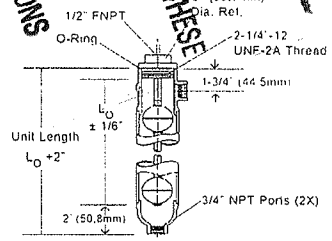
Installation Multi-station level switches install vertically in tank top (mounting up) or in tank bottom (mounting down). Level switches will operate normally inclined up to 30°.

Mounting Types

*Note: Units greater than 72" overall length are supplied with collar with set screws made of same material as stem, and mounted to select float stop ring. Spacers, an optional on units less than 72" overall length, are required on units 72" and greater. Float stops must be specially ordered with 316 SS collars instead of brass.

	Type 1 1/2" NPT	Type 2 1-1/4" NPT	Type 3 2" NPT	Type 4 3" Dia., 150# Flange
				
Stem and Mounting Material	Brass or 316 Stainless Steel			Flange: Carbon Steel or 316 SS Stem: 316 SS
Max. Length (LO)	36"	60"		140"
Mounting Position	Vertical ±30° Inclination			
*Float Stops (See *Note Above)	Brass Units: Beryllium Copper Grip Rings; Stainless Steel Units: S.S. ARMCO PH-15-7MO Grip Rings			

Type 5 - External Mount



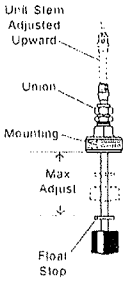
Housing Material	Brass	316 Stainless Steel
Stem & Mounting	Brass	316 Stainless Steel
Port Sizes	3/4" NPT	
Max. Length (LO)	120"	
*Float Stops	Beryllium Copper	S. S. ARMCO PH-15-7 MO

LS-800 Adjustable Mounting

Adjustable mounting is available for LS-800 Series Mounting Types 2, 3, and 4. A special cinch nut on the mounting allows the stem to travel up or down for fine tuning of the actuation points. The extent of adjustment depends on the unit length and the distance from the mounting to the highest float stop.

Note

Maximum overall length is limited to 72" with this option.



Installation Procedure for Model LS-802 - Two-Piece Level Switch

1. Unpack unit from shipping crate.
2. Position unit near tank and unstrap stem assemblies.
3. The lower stem section (section with floats) can be inserted into tank to facilitate ease of installation, but must be retained to install upper section.
4. With lower stem in desired position, insert tube coupling from upper stem section into lower section. Tighten coupling nut securely to stem (~ 1 turn past handtight). Check and tighten the upper section nut, if necessary.
5. Cable exiting from the upper section conduit connector can be lightly pulled taught through grommet to prevent excess cable slack in upper stem.
6. Install unit in tank and tighten mounting plug.
7. Connect level switch wires per wiring diagram.

Integrated Temperature Sensors Options

1. **Thermistor for Continuous Indication**
   - Excellent Repeatability

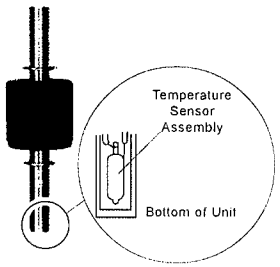
   Value: 10,000 ohms @ 77°F (25°C)

   Tolerance: ±0.2°C from 32°F to 158°F (0°C to 70°C)

   Operating Temperature: 302°F (150°C), Max.

   Alpha @ 25°C: -4.39%/°C

   Dissipation Constant: 1mW/°C in Still Air
   8 mW/°C in Oil Bath



Note
End of unit stem must be submerged a minimum of 2-3/4" for level switch actuation.

2. **Thermostat for Switch Action**
   - Settings from 150°F to 175°F
   - Open or close switch on increasing temperature

Note
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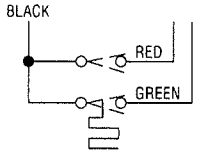
Typical Wiring Diagram



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Fax: 860-793-4563

Important Points:

- Gems products must be maintained and installed in strict accordance with the National Electrical Code and the applicable Gems product instruction Bulletin that covers installation, operation and proper maintenance. Failure to observe this information may result in serious injury or damages.
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- *** Warning: To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.
- Please adhere to the pressure and temperature limitations shown throughout this catalog for our level and flow sensors. These limitations must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/ temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of Gems products. Take care in the proper selection of materials of construction, testing is required.
- NSF-approved sensors are made of materials approved for potable water applications according to Standard 61.
- Stainless steel is generally regarded as safe by NSF and FDA.
- Life expectancy of switch contacts varies with application. Contact Gems if life cycle testing is required.
- Ambient temperature changes do affect switch set points, since the gravity of a liquid can vary with temperature.
- Our sensors have been designed to resist shock and vibration. However, shock and vibration should be minimized.
- Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.
- Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.
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- Physical damage sustained by product may render it unserviceable.

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One Cowles Road
Plainville, CT 06062-1198
Toll-Free: 1-800-378-1600

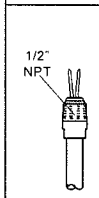
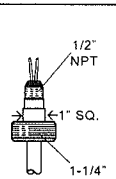
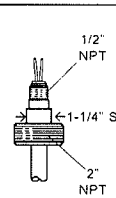
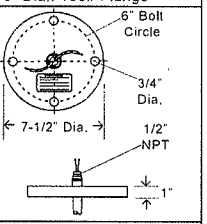
Instruction Bulletin No. 72978 (Rev P)

Series LS-800, LS-800 Adjustable Multi-Station Level Switches

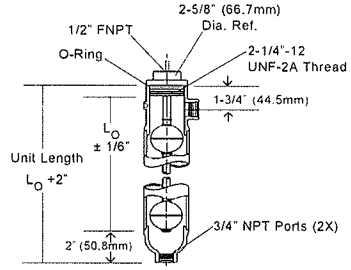
(Includes LS-800's with Temperature Sensors)

Installation Multi-station level switches install vertically in tank top (mounting up) or in tank bottom (mounting down). Level switches will operate normally inclined up to 30°.

Mounting Types
***Note:** Units greater than 72" overall length are supplied with collars with setscrews (made of same material as stem and mounting), in place of float-stop rings. Collars are optional on units less than 72" overall length. Units requiring 316 SS float stops must be special-ordered with 316 SS collars instead of grip rings.

	Type 1 1/2" NPT	Type 2 1-1/4" NPT	Type 3 2" NPT	Type 4 3" Dia., 150# Flange
				
Stem and Mounting Material	Brass or 316 Stainless Steel			Flange: Carbon Steel or 316 SS Stem: 316 SS
Max. Length (LO)	36"	60"	140"	
Mounting Position	Vertical ±30° Inclination			
*Float Stops (See *Note Above)	Brass Units: Beryllium Copper Grip Rings; Stainless Steel Units: S.S. ARMCO PH-15-7MO Grip Rings			

Type 5 - External Mount

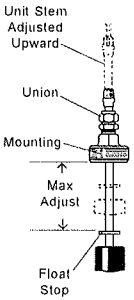


Housing Material	Brass	316 Stainless Steel
Stem & Mounting	Brass	316 Stainless Steel
Port Sizes	3/4" NPT	
Max. Length (LO)	120"	
*Float Stops	Beryllium Copper	S. S. ARMCO PH-15-7 MO

LS-800 Adjustable Mounting

Adjustable mounting is available for LS-800 Series Mounting Types 2, 3, and 4. A special cinch nut on the mounting allows the stem to travel up or down for fine tuning of the actuation points. The extent of adjustment depends on the unit length and the distance from the mounting to the highest float stop.

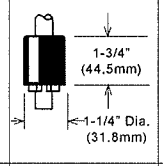
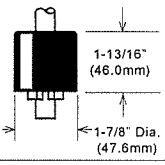
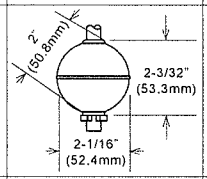
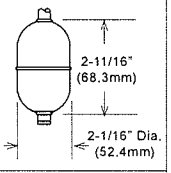
Note
Maximum overall length is limited to 72" with this option.



Installation Procedure for Model LS-802 - Two-Piece Level Switch

1. Unpack unit from shipping crate.
2. Position unit near tank and unstrap stem assemblies.
3. The lower stem section (section with floats) can be inserted into tank to facilitate ease of installation, but must be retained to install upper section.
4. With lower stem in desired position, insert tube coupling from upper stem section into lower section. Tighten coupling nut securely to stem (~ 1 turn past handtight). Check and tighten the upper section nut, if necessary.
5. Cable exiting from the upper section conduit connector can be lightly pulled taught through grommet to prevent excess cable slack in upper stem.
6. Install unit in tank and tighten mounting plug.
7. Connect level switch wires per wiring diagram.

Float Types

Float Material	Buna N		316 Stainless Steel	
Compatible Mounting Types	2	1, 3, 4, 5	1, 3, 4, 5 (Units <72")	3, 4, 5 (Units >72")
Float Dimensions				
Part Number	26032	10558	14569	15666
Operating Temperature	Water: To 180°F (82.2°C) Oil: -40°F to +230°F (-40°C to 110°C)		-40°F to +300°F (-40°C to +148.9°C)	
Min. Media Specific Gravity	.75	.55	.75	.75

Pressure Ratings Chart

(PSI, Max.)

			Float Part Number			
			26032	10558	14569	15666
Mounting Type	1, 2, 3		150		750	300
	4		150			
	5	Brass	100 @ +70°F (21.1°C)			
		316 S.S.	150		750	300

Wiring Color Codes

SPST Switches				SPDT Switches 20 VA				
Wiring	Group I	Group II		Group III		Group IV		
Com. Wire	Black	None		Black		None		
	NO/NC	Sw. Com.	NO/NC	NO	NC	Sw. Com.	NO	NC
L1	Red	Red	Red	Red	Wh/Red	Red	Wh/Red	Wh/Blk/Red
L2	Yellow	Yellow	Yellow	Yellow	Wh/Yel	Yellow	Wh/Yel	Wh/Blk/Yel
L3	Blue	Blue	Blue	Blue	Wh/Blu	Blue	Wh/Blu	Wh/Blk/Blu
L4	Brown	Brown	Brown	Brown	Wh/Brn	Brown	Wh/Brn	Wh/Blk/Brn
L5	Orange	Orange	Orange	Orange	Wh/Orn	Orange	Wh/Orn	Wh/Blk/Orn
L6	Gray	Gray	Gray	Gray	Wh/Gray	Gray	Wh/Gray	Wh/Blk/Gra

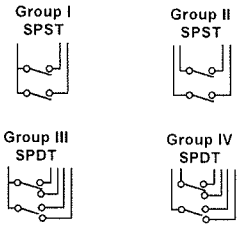
Notes:
1. Multi-station units included in shaded areas of chart can be supplied in UL-recognized configurations.
2. Wire size is #18 AWG for units of UL-recognized configurations and #22 AWG (Teflon) for non-UL- recognized configurations.
3. Units with 50 or 100 VA switches are not UL-recognized.

Electrical Specifications

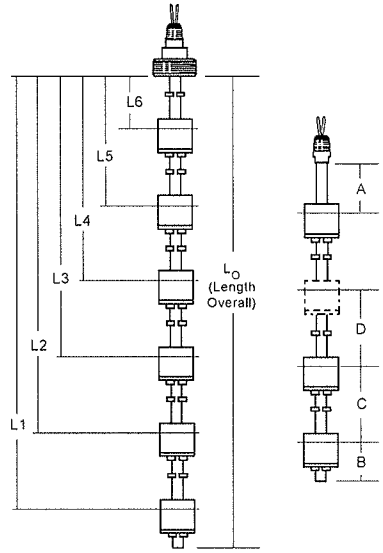
Switch (N.O. or N.C.):
SPST: 20 VA or 100 VA
SPDT: 20 VA
Lead Wires: #22 AWG, 24" L., Polymeric

Typical Wiring Diagrams

For clarity, only two actuation levels are shown in each group diagram.



Actuation Level Dimensions



*Actuation level distances and L_O (overall unit length) are measured from inner surfaces of mounting plug or flange.

** Length Overall $L_O = L_1$ + Dimension B. See mounting types for maximum length values.

Switch Ratings - Maximum Resistive Load

VA	Volts	Amps AC	Amps DC
10 General Use	0-50	.2	.13
	120	.08	N.A.
	100	N.A.	.1
20 Pilot Duty	1-30	.4	.3
	120	.17	.13
	240	.08	.06
50 General Use	0-50	0.5	0.5
	120	.4	.4
	240	.2	.2
100*	120	.8**	N.A.
	240	.4	N.A.

* Level switch units with 50 VA and 100 VA swtiches are not UL recognized or CSA approved.

** Limited to 50,000 operations

Switch actuation levels are determined following the guidelines below:

All units 72" or less length overall with stainless steel or Buna N floats. Also Type 5 units over 72" length overall with Buna N floats:

A = 1-1/2" minimum distance to highest level (2", Type 5 only)
B = 2" minimum distance from end of unit to lowest level
C = 3" minimum distance between levels
D = 1/4" minimum distance between actuation levels (Note: One float for two levels can be used only when low level is N.C. dry and high level is N.O. dry.)

Types 1, 3, 4 and 5 units with stainless steel float P/N 15666:

A = 1-5/8" minimum distance to highest level (2", Type 5 only)
B = 2-1/2" minimum distance from end of unit to lowest level
C = 4" minimum distance between levels
D = 1/4" minimum distance between actuation levels (Note: One float for two levels can be used only when low level is N.C. dry and high level is N.O. dry.)

Notes:

1. A, B, and C dimensions are based on liquid specific gravity of 1.0.
2. One float for two levels can be used only when 20VA switch is used.
3. Actuation levels are calibrated on descending fluid level, with water as types for maximum length values, the calibrating fluid, unless otherwise specified.
4. Tolerance on actuation levels is ±1/8".

SECTION 9.1 HEATING, VENTILATION & AIR CONDITIONING

Section 9.1 Heating, Ventilation & Air Conditioning

9.1.11 Eemax Tankless Water Heaters

Model # SP3208

Tag # NA

Eemax®

"SINGLE POINT"

CODE COMPLIANT HANDWASHING HEATERS

Instant Comfort...Endless Savings

ELECTRIC TANKLESS WATER HEATERS

9/06

MODELS:

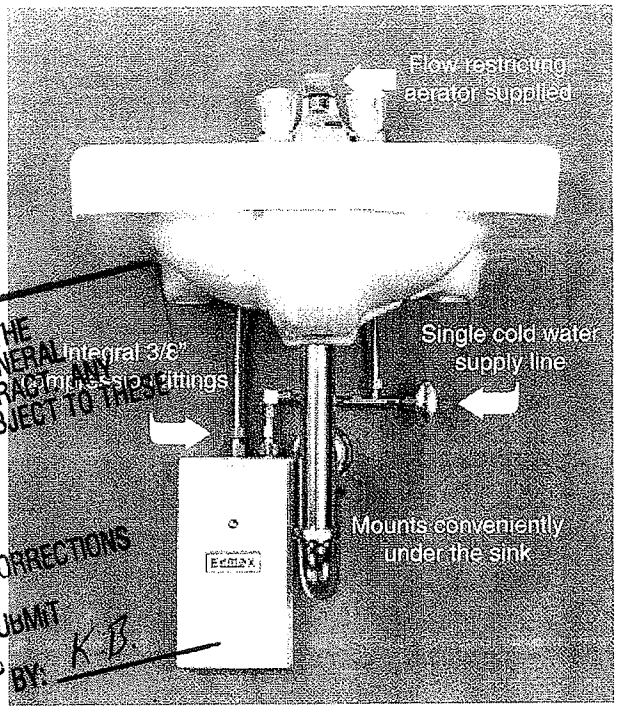
	Volts	kW	Amps
SP2412	120V	2.4kW	20A
SP3012	120V	3.0kW	25A
SP3512	120V	3.5kW	29A
SP3208	208V	3.0kW	14.4A
SP4208	208V	4.1kW	19.7A
SP35	240V	3.5kW	14.6A
SP48	240V	4.8kW	20A
SP55	240V	5.5kW	22.9A
SP3277	277V	3.0kW	10.8A
SP4277	277V	4.1kW	14.8A

SPECIFICATION OPTIONS:

☐ FC = Flex Connector braided stainless steel water connections available (EEMAX X177)
Example: SP3512FC

APPLICATIONS:

- Shopping Malls
- Office and Tenant Spaces
- Commercial Buildings (restaurants, etc.)
- Modular Buildings/Modular Offices
- Public Hand Washing
- Service Stations
- Schools
- Concessions Stands, Stadiums



Designed to comply with .5 GPM handwashing code target outlet temperature 105° - 110°.

REVIEWED ACCORDING TO THE REQUIREMENTS OF THE GENERAL CONDITIONS OF THE CONTRACT. ANY ACTION INDICATED IS SUBJECT TO THESE REQUIREMENTS.
☑ REVIEWED
☐ MAKE NOTED CORRECTIONS
☐ REVISE & RESUBMIT
DATE: July 92 0/6 BY: K.B.

ADVANCED TECHNOLOGY • HIGHEST EFFICIENCY
DESIGNED FOR DURABILITY

MADE IN USA

QUALITY FEATURES

- **On Demand Hot Water** - no delay.
- **Cut Energy Waste** - flow switch activates heater only on demand (no standby heat loss). **99% efficient**
- **Continuous Hot Water** - no storage capacity to run out.
- **Reduces Installation Cost** - no T & P relief valve needed (check local codes).
- **Easy Installation** - only one cold water line need be brought to lavatory - integral ⅜" compression fittings on top (no sweat connections). Mounts on wall at point-of use.
- **Integral Flow Restrictor** - Built in to ensure proper temperature rise. Complies with U.S. Federal regulations.
- **Faucet Aerator** - with excellent spray pattern supplied with unit.
- **Hands Free**, sensor and metering faucet compatible
- **Prevents Legionella Bacteria Growth**
- **Reduces Liming, Calcification and Sedimentation.**
- **Complies with Handicap Requirements**
- **Ni Chrome Element** - a unique, patented flow path ensures optimum heat transfer and extended element life.
- **Compact Size** - dimensions 10.75" x 5.25" x 2.875"; weight 3 lbs.
- **Field Serviceable Element** - replaceable cartridge element (1 year warranty).
- **Warranty** - Full Factory Warranty - Heaters are guaranteed against failure due to leaks of "Heater Body/Element Assembly" for a period of FIVE YEARS.
- **High Temperature Limit Switch** - protects against element burn out, with reset button.

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SP55	240V	5.5kW	22.9A
SP3277	277V	3.0kW	10.8A
SP4277	277V	4.1kW	14.8A

SPECIFICATION OPTIONS

☐ FC = Flex Connector braided-stainless steel water connections available. (EX176, EX177)
Example: SP3512FC

APPLICATIONS:

- Shopping Malls
- Office and Tenant Spaces
- Commercial Buildings (restaurants, etc.)
- Modular Buildings/Modular Offices
- Public Hand Washing
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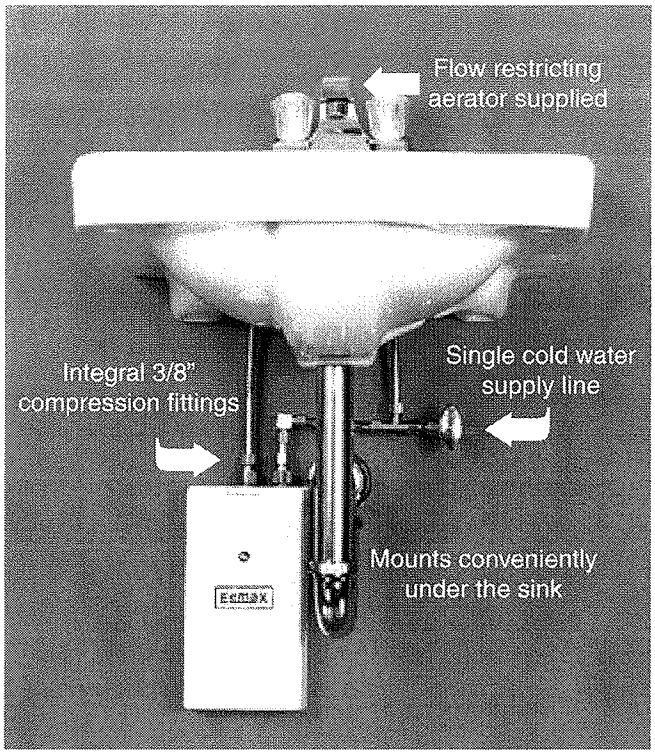
- Schools
- Concessions Stands, Stadiums


Flow restricting aerator supplied
Integral 3/8" compression fittings
Single cold water supply line
Mounts conveniently under the sink

Designed to comply with .5 GPM handwashing code target outlet temperature 105° - 110°.

ADVANCED TECHNOLOGY • HIGHEST EFFICIENCY
DESIGNED FOR DURABILITY

MADE IN USA

QUALITY FEATURES

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- **Faucet Aerator** - with excellent spray pattern supplied with unit.
- **Hands Free**, sensor and metering faucet compatible
- **Prevents Legionella Bacteria Growth**
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- **Complies with Handicap Requirements**
- **Ni Chrome Element** - a unique, patented flow path ensures optimum heat transfer and extended element life.
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- **Field Serviceable Element** - replaceable cartridge element (1 year warranty).
- **Warranty** - Full Factory Warranty - Heaters are guaranteed against failure due to leaks of "Heater Body/Element Assembly" for a period of FIVE YEARS.
- **High Temperature Limit Switch** - protects against element burn out, with reset button.

SUGGESTED SPECIFICATION

Tankless Water Heater shall be an Eemax Model _____ (model #) with , _____ (kW rating) vac, _____ (voltage) to heat 0.5 GPM @ a temperature rise of _____ (amperage) degrees F. Unit shall have ABS-UL 94Vo rated cover. Element shall be replaceable cartridge insert. Unit shall have a replaceable filter in the inlet connector and a flow regulator in the outlet connector. Element shall be iron free, nickel chrome material. Heater shall be fitted with ⅜" compression nuts and sleeves to eliminate need for soldering. Heater shall be installed upright with water connections on top only. Hot water storage tanks prohibited. Unit shall be Eemax or approved equal.
NOTE: Refer to rating chart for product information.

NOTE: Flow Activated 0.5 GPM

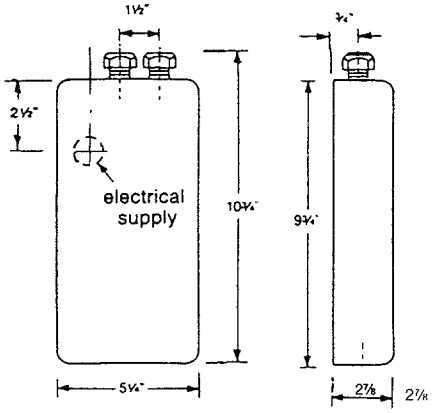
OPERATING PRESSURE	
Min.	Max.
25 PSI	150 PSI

OPTIONAL FLEX CONNECTOR ACCESSORY (FC)

Stainless steel braid reinforced flexible water connector.
☐ 3/8" C x 1/2" FIP - 16" faucet supply (EX176)
or
☐ 3/8" C x 3/8" C - 16" faucet supply (EX177)

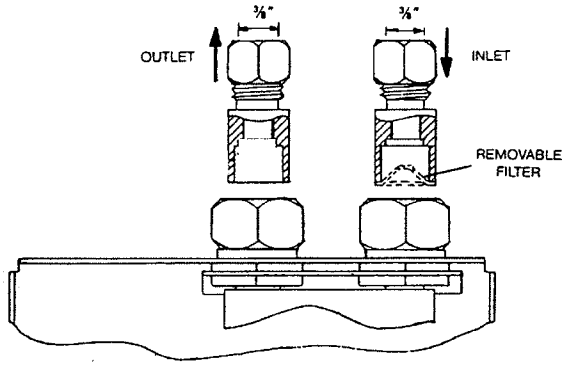
RATINGS OF SINGLE POINT UNITS { Cold water feed only }

MODEL	VOLTS	kW	AMPS	RISE AT 0.5 GPM	RECOMMENDED WIRE SIZE
SP2412	120V	2.4kW	20A	33°	10AWG
SP3012	120V	3.0kW	25A	41°	10AWG
SP3512	120V	3.5kW	29A	48°	10AWG
SP3208	208V	3.0kW	14.4A	41°	14AWG
SP4208	208V	4.1kW	19.7A	56°	12AWG
SP35	240V	3.5kW	14.6A	48°	14AWG
SP48	240V	4.8kW	20A	65°	12AWG
SP55	240V	5.5kW	22.9A	75°	10AWG
SP3277	277V	3.0kW	10.8A	40°	14AWG
SP4277	277V	4.1kW	14.8A	56°	14AWG



SPECIFICATIONS:

Dimensions: 10.75" x 5.25" x 2.875"
Weight: 3 lbs.
Materials:
Cover: ABS UL rated 94Vo.
Color: White
Element: Replaceable cartridge insert
Pipe-Fittings: 3/8" compression at top of unit
UL Listed: E86887 (M)
U.S. Patent #'s: 4,762,980 and 4,960,976



c UL us LISTED

SPECIAL DESIGN SERVICE INQUIRIES FOR UNITS FOR UNIQUE APPLICATIONS ARE WELCOME. CALL OUR TECHNICAL SERVICE DEPT. 1-800-543-6163

EEMAX SUBMITTAL

Engineer/Architect: _____
Job Name/Customer: _____
Location: _____
Contractor: _____
Representative: _____
HEATER SPECIFICATIONS:

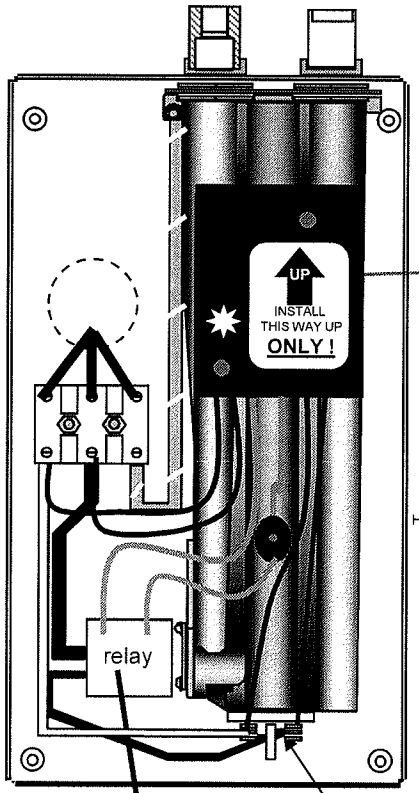
	Option	Quantity	kW	Voltage	AMPS	GPM
Single Point Model # SP_____	_____	_____	_____	_____	_____	___

Eemax® Inc.
353 Christian Street, Oxford, CT 06478
www.eemax.com
Telephone: (203)267-7890
TOLL FREE: 1-800-543-6163
FAX: (203) 267-7975

Replacement Parts for "Single Point" Units

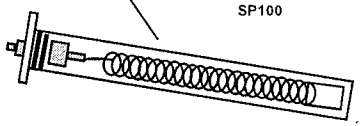
½" PIPE (5/8"OD)COMPRESSION NUT AND SLEEVE PART# EX16, EX17

3/8" COMPRESSION ADAPTOR WITH NUT AND SLEEVE PART#EX68A,B,C



CONTROL BOARD EX182DP SPECIFY VOLTAGE AND MODEL

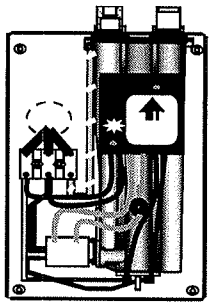
RELAY PART # EX250-255



ELEMENT CARTRIDGE

HEATER MODEL/ORDER REF.	CARTRIDGE REF #
SP2412 (120V)	EX610SP
SP3012	EX480SP
SP3512	EX410SP
SP3208 (208V)	EX1440SP
SP4208	EX1050SP
SP8208	EX520SP
SP35 (240V)	EX1650SP
SP55	EX1050SP
SP65	EX890SP
SP75	EX770SP
EX95	EX630SP
SP3277 (277V)	EX260SP
SP4277	EX1870SP
SP60	EX1280SP
SP80	EX960SP
SP90	EX850SP
SP100	EX760SP

Eemax®



INSTANT COMFORT...ENDLESS SAVINGS

"Single Point"

ELECTRIC INSTANTANEOUS WATER HEATER
INSTALLATION GUIDE AND OWNERS MANUAL

WARNING

BEFORE ATTEMPTING INSTALLATION OF THIS UNIT OR MAKING ANY ADJUSTMENTS TO THE UNIT, ALWAYS BE SURE CIRCUIT BREAKER IS OFF TO PREVENT DANGER OF SERIOUS ELECTRIC SHOCK.
FAILURE TO GROUND THE SYSTEM MAY RESULT IN SERIOUS INJURY OR DEATH

INSTALLER/ CONSUMER RESPONSIBILITIES

READ THIS MANUAL CAREFULLY BEFORE ATTEMPTING TO INSTALL OR OPERATE THIS WATER HEATER. IF THE SAFETY RULES ARE NOT FOLLOWED, THE UNIT WILL NOT OPERATE PROPERLY AND IT COULD CAUSE DEATH, SERIOUS BODILY INJURY AND/OR PROPERTY DAMAGE.
WARRANTY OF THIS WATERHEATER WILL DEPEND ON PROPER INSTALLATION AND OPERATION. THE WARRANTY WILL BE VOID IF THE DESIGN HAS BEEN ALTERED IN ANY WAY WHATSOEVER. THE MANUFACTURER OF THIS HEATER WILL NOT BE LIABLE FOR ANY DAMAGES BECAUSE OF FAILURE TO COMPLY WITH THE INSTALLATION AND OPERATING INSTRUCTIONS OUTLINED ON THE FOLLOWING PAGES.

THE INSTALLATION MUST CONFORM WITH THE INSTRUCTIONS IN THIS MANUAL AND LOCAL CODES, OR INTHE ABSENCE OF LOCAL CODES, WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE. THIS PUBLICATION IS AVAILABLE FROM YOUR LOCAL GOVERNMENT, ELECTRIC CO., PUBLIC LIBRARY, OR BY WRITING UNDERWRITERS LABORATORIES, 333 PFINGSTEN RD., NORTHBROOK, IL. 60062

IF YOU REQUIRE HELP OR HAVE ANY QUESTIONS RELATING TO THE INSTALLATION OR PERFORMANCE OF THIS HEATER, PLEASE CALL OUR TECHNICAL SERVICE DEPARTMENT TOLL FREE:1-800-543-6163.
HAVE THE INFORMATION LISTED BELOW BEFORE CALLING:
MODEL NO._____SERIAL NO._____INSTALLATION DATE_____

Eemax Inc., 353 Christian Street Oxford, CT 06478
TEL:1-800-543-6163, 203-267-7890, FAX: 203-267-7975, e-mail: eemaxinc@aol.com

GENERAL

The Eemax "Single Point" heater is specifically designed to be installed "under sink" feeding a SINGLE faucet(5.5kW and lower) It is designed to take in cold water ONLY and heat it to temperatures suitable for hand washing. To obtain optimum performance and energy savings, the unit should be located as near as possible to the point of use. The heater incorporates a constant flow device and should only be used with the faucet aerator supplied with this heater by Eemax. The unit is supplied with compression rings and nuts suitable for direct coupling to 3/8" copper or plastic piping. Do not use additional screwed fittings or pipe dope. Doing so will void the warranty. **DO NOT SOLDER PIPES WHILE THE UNIT IS INSTALLED/ DO NOT USE PIPE DOPE OR TEFLON TAPE** (serious damage to the electronic flow switch will result).

This heater must have its own independent circuit, using a correctly rated breaker and wires suitable for at least 75 °C operation.

Failure to ground this system may result in death or serious injury.

1) MOUNTING THE UNIT

1) The unit should be mounted as close to the point of use as possible.

2) This unit must only be mounted in the vertical position with the water fittings at the top of the unit. Mounting other than in the vertical upright position WILL cause element burn out.

3) The cold water inlet is on the right hand side and the hot water outlet is on the left hand side. Under NO circumstances can these be reversed.

4) Leave a minimum of 8" below the unit for easy replacement of the element.

5) The heater should be fixed to the wall using the four mounting holes at each corner of the backplate.

NOTE: The heater should be installed below the level of all hot water outlets serviced by this heater.

NOTE: PRESSURE RELIEF DEVICE

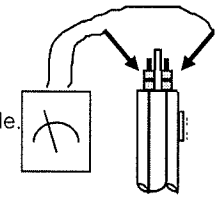
This unit is not required by UL to have a Pressure and Temperature safety relief valve (PTRV). You should check with local codes to find out if one is required in your area.
If local codes require the use of temperature and pressure relief valve it should be installed on the outlet hot water pipe before the outlet ball valve.

TROUBLE SHOOTING

SYMPTOM: NO HEAT INDICATOR LIGHT OFF

1) ELECTRIC SUPPLY IS OFF
Turn on the main breaker.

2) NO OR LOW WATER FLOW
Ensure that the minimum flow rate to switch on your heater is met.
Models minimum flow rate = 0.75 gallons per minute
"SP8208, 80, 90, 100, 75, 95"
Models minimum flow rate = 0.6 gallons per minute
"SP60,65"
Models minimum flow rate = 0.5 gallons per minute
"SP2412, 3012, 3512, 3208, 4208, 3277, 4277, 35, 55"
Also check that the inlet filter screen is clear from any debris. This is located in the brass inlet boss.



3) WATER CONNECTIONS ARE REVERSED
The correct plumbing configuration is
Cold water inlet = right side, hot water outlet = left side.

4) ELEMENT BURNED OUT
TURN OFF THE breaker!
Using an ohmmeter test the resistance of the heating element across the two threaded termination rods on top of the element.
The resistance reading should be under 10 ohms.
If the resistance is much greater than this value, call Eemax for a replacement element.
5) ECO TRIPPED (High Limit Thermostat)
TURN OFF THE FOUR MAIN CIRCUIT BREAKERS!
Reset by pushing in red button on each heater module.

SYMPTOM: NO HEAT OR LOW TEMPERATURE WITH INDICATOR LIGHT ON
1) WATER FLOW TOO HIGH
Reduce the water flow by using an outlet ball valve. See page 3 for temperature rise at various flow rates.

2) INCORRECT POWER SUPPLY
Make sure that the unit is connected to the voltage supply specified on the rating label on the the front cover of the unit and no other.

3) ELEMENT BURNED OUT
TURN OFF THE breaker!
Repeat the steps from paragraph 4 above.

4) COMMISSIONING YOUR HEATER

IMPORTANT
Before switching "on" the power at the breaker make sure that the hot water circuit is free of air pockets or premature failure of the heating element will occur. To do this open all hot water faucets one at a time for a minute or two until the water flow is continuous and free from "gulping" and from visible air pockets.

1) With inlet and outlet BALL VALVES fully open, turn on all hot water outlets.

2) Run for 5 minutes, turning faucet "on" and "off" repeatedly.

3) Switch on electric supply at breaker.

4) The power indicator light should now come on (see Fig. 1).
NOTE: At this point water temperature may not be very hot.

5) Using the OUTLET BALL VALVE slowly reduce water flow until desired temperature is achieved at hot water outlet.

NOTE: The water temperature is proportional to the flow through the heater. The lower the flow the higher the temperature and vice versa.

6) Check performance of flow switch by opening and closing outlet valve a few times. The power indicator light should be on **ONLY** when water is flowing through the unit. For expected temperature rise at various rates of flow see chart.

NOTE: An SP55 (5.5 kW) unit at 240 V will deliver 0.5 gallon per minute at 75°F temperature rise. For example, with incoming water temperature at 45°F the unit will produce 0.5 gallon per minute at (45+75)=120°F.

7) It is possible that drawing off cold water at comparatively high rates of flow elsewhere in the building at the same time that the heater is working, could cause premature element failure. Care should be taken not to starve the unit of cold water. To prevent this from happening, open fully the main valve on the cold supply to the building and throttle back the control valves to the other cold water outlets.

Note: "Single Point" units comes with a faucet mounted aerators, these should be mounted on the faucets served by this unit.

2) PLUMBING HOOK-UP

1) The unit is supplied with compression fittings. USE THESE: DO NOT USE THREADED PIPE FITTINGS. DO NOT USE PIPE DOPE OR TEFLON TAPE ON THIS INSTALLATION. Ensure the inlet filter supplied with this unit is in place.

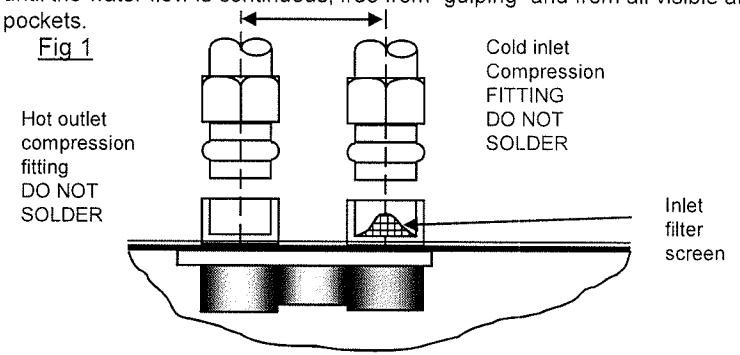
2) Take care to ensure that the pipes are correctly aligned with the inlet and outlet bosses in order to avoid excessive stress on the heater body molding.

NOTE: Run water through the supply pipe to remove all debris from the pipe before connecting the heater. Failure to do so could damage the flow switch.

3) Install isolating valves (full flow ball valve type) on both inlet and outlet pipes. This allows unit to be isolated for maintenance purposes. (Fig. 2)

4) When all plumbing is complete, fully check the system for water leaks at all plumbing connections. If leak is present take corrective action. If leak is at the compression fitting, slowly tighten compression nut until it stops. Ensure compression fittings are tighten to 18FT.LB.
Fully open both inlet and outlet ball valves.
Run all hot water outlets fed by this heater one at a time for a minute or two until the water flow is continuous, free from "gulping" and from all visible air pockets.

Fig 1



NOTE:
ALL PLUMBING MUST BE COMPLETED BEFORE YOU PROCEED WITH THE ELECTRICAL HOOK-UP.

TEST THE INSTALLATION FOR LEAKS BEFORE CONNECTING THE ELECTRICAL SUPPLY.

3) ELECTRICAL HOOK-UP

WARNING
BEFORE BEGINNING ANY WORK ON THE INSTALLATION BE SURE THAT THE BREAKER IS "OFF" TO AVOID ANY DANGER OF SHOCK.

Your Eemax heater must have its own independent circuit using insulated, UL listed, 3 wire cable of the appropriate size suitable for use up to 75 °C protected by the correctly rated circuit breaker.

RATINGS OF "SP" UNITS

MODEL	VOLTS	kW	AMPS	0.5 gpm	0.6 gpm	0.7 gpm
SP2412	120	2.4	20	33	-	-
SP3012	120	3.0	25	41	34	29
SP3512	120	3.5	29.2	48	40	34
SP3208	208	3.0	14.4	41	34	29
SP4208	208	4.1	19.7	56	47	40
SP8208	208	8.3	40	-	-	81
SP3277	277	3.0	10.8	41	34	29
SP4277	277	4.1	14.8	56	47	40
SP60	277	6.0	22	-	68	58
SP80	277	8.0	29	-	-	78
SP90	277	9.0	33	-	-	88
SP100	277	10.0	36	-	-	97
SP35	240*	3.5	14.6	48	40	34
SP55	240*	5.5	22.9	75	63	54
SP65	240*	6.5	27	-	73	63
SP75	240*	7.5	32	-	-	73
SP95	240*	9.5	40	-	-	92

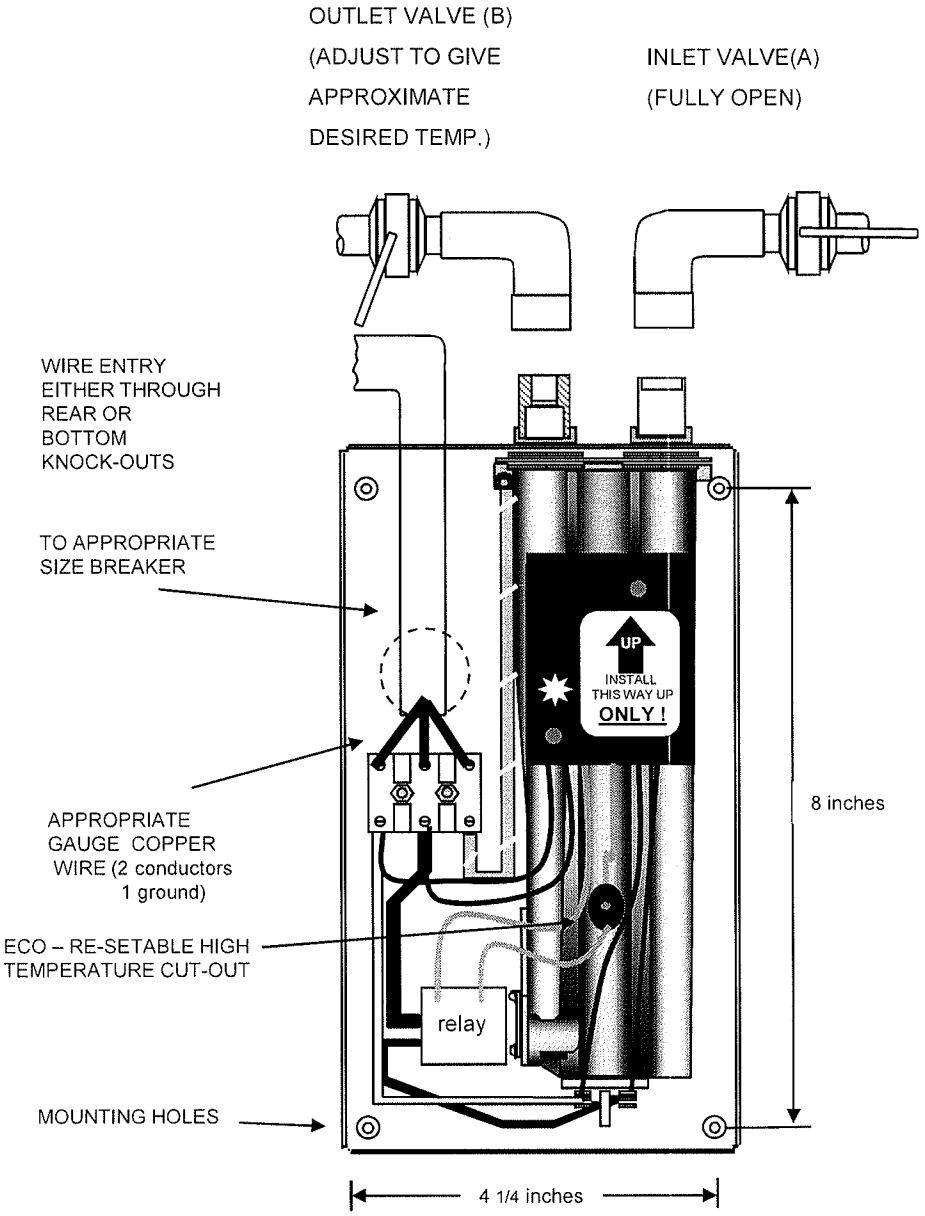
* The heaters are rated at 240 Volts. If the actual voltage supplied is lower (220, 208V) there will be a proportional drop in output.

1) Wire entry into the unit should be made through the lower right hand corner of the backplate via one of the two "knockout" holes provided.

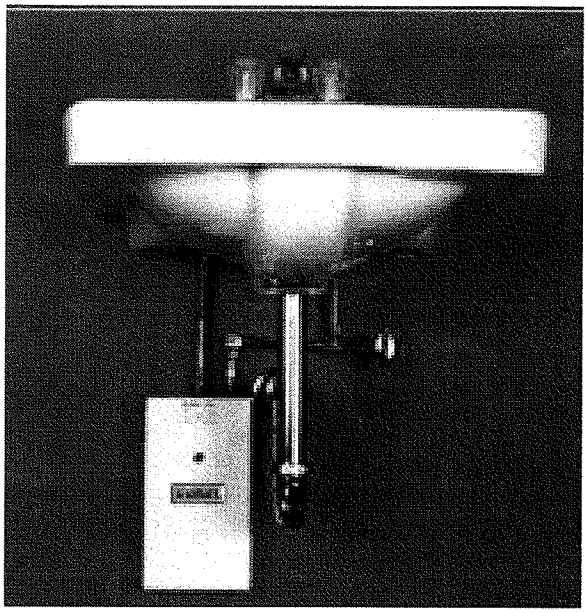
2) The "mains" wires should be connected to the slots in the terminal block marked L1 and L2 or N. The ground lead **MUST** be connected to the marked. ⏚ Failure to ground the system may result in death or serious injury.

WARNING:
This water heater must not be switched "on" if there is a **possibility** that the water in the heater is frozen.

FIGURE 2



Eemax®



"SP"- MODELS

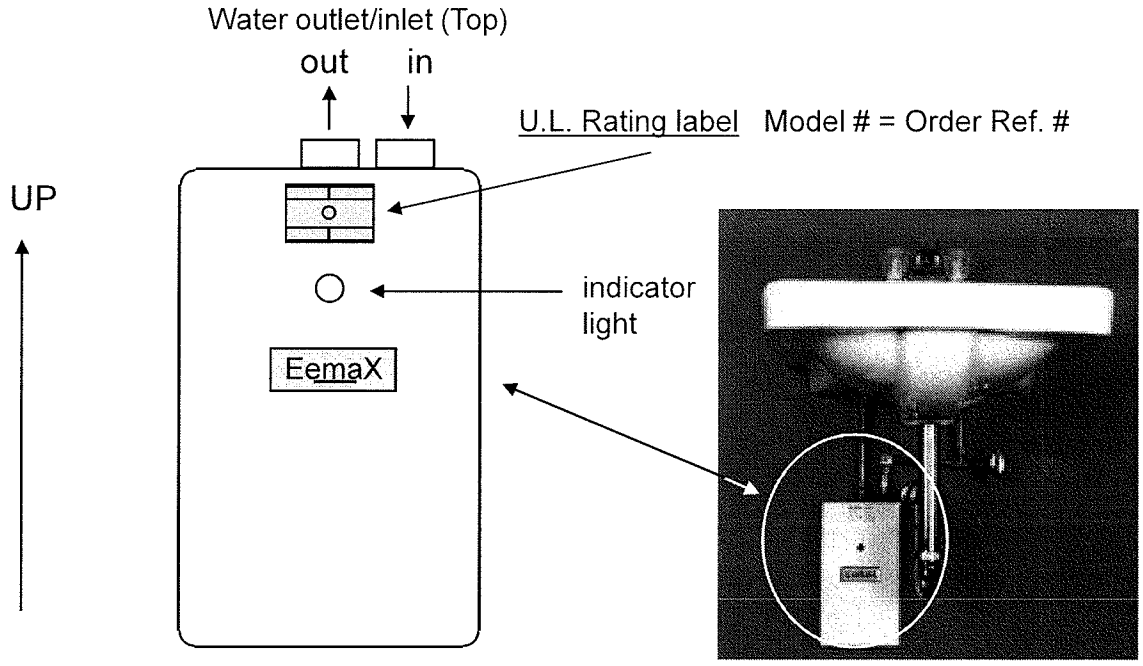
INSTRUCTIONS FOR TROUBLESHOOTING YOUR EEMAX WATER HEATER

Everything you need to know about troubleshooting your Eemax unit is contained in this fully illustrated guide. If you still have problems after reading and carrying out the instructions in this manual then please call the Eemax technical support department on the toll free number below and we will be happy to help.

PHONE TOLL FREE- 800/543-6163

PAGE TWO

SP-MODELS



This is how your Eemax "SP" model should look when mounted correctly on the wall.

Any other mounting configuration is wrong and the unit will not work!

Check to see if you have an " SP" model on the U.L. rating label on the front cover of your Eemax unit.

If the unit is mounted correctly and still does not produce hot water then have a look to see if the indicator light comes on when the hot water faucet is fully opened.

If the light comes on turn to page 5
If the light does not come on turn to page 3

PAGE THREE

The Indicator light does not come on (when the hot water faucet is opened):

STEP ONE:

_____Is the circuit breaker switched on at the breaker panel?

YES ⟶ Go to Step two

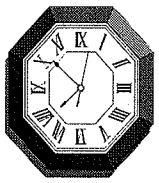
NO ⟶

Run water at the hot faucet for a couple of minutes before turning on the breaker. Turn on breaker.

STEP TWO:

_____The unit won't switch on unless enough water is flowing through the heater.

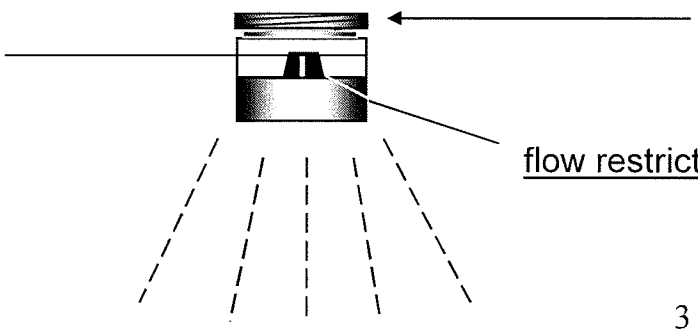
You will need a flow rate of about 0.5 gallons per minute (1/2 gpm). Measure the flow rate.



Take a 1 gallon "milk" container and using only water from the hot outlet time how long it takes to fill. Longer than 2 minutes and you probably do not have enough water flow to turn on the unit.
Open all water valves as much as possible.

If this does not work try unscrewing the aerator situated on the end of your faucet. Now run the water with the faucet open fully, if the indicator light still does not illuminate then proceed to step 3.

Aerator - Fits on the end of the faucet.



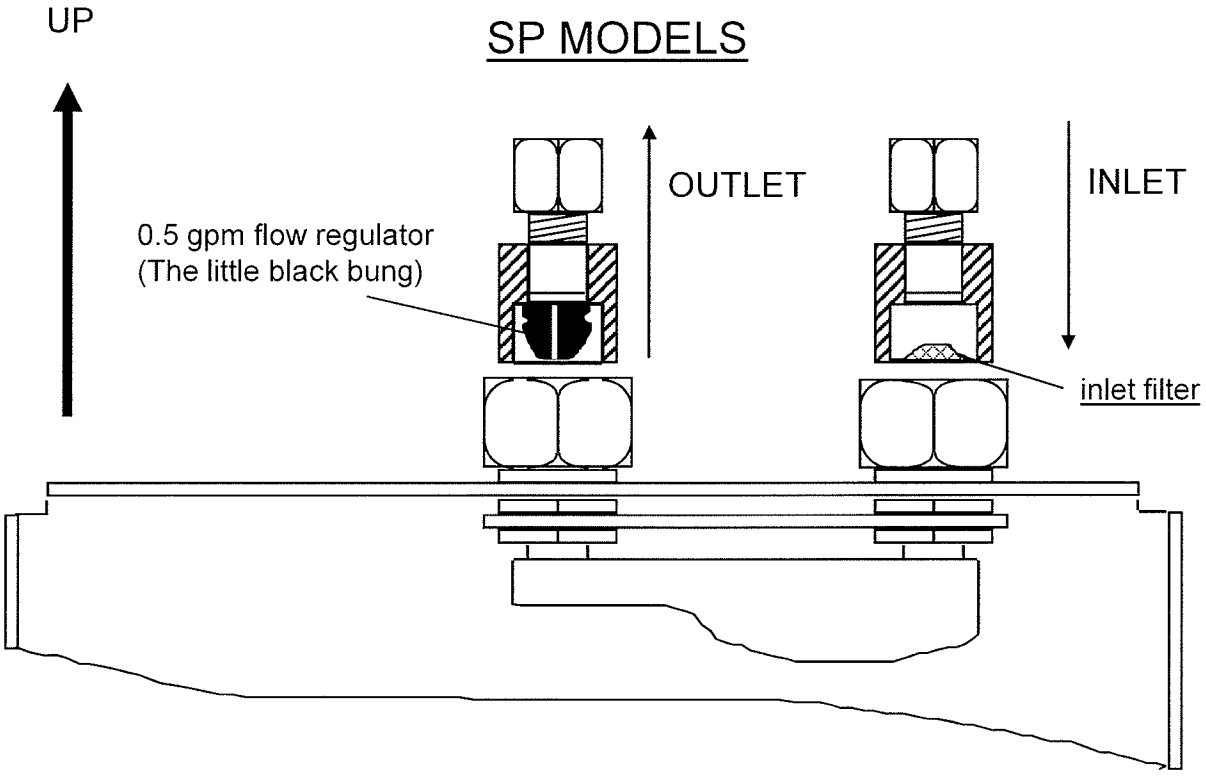
Male/female threaded adapter on top of aerator.

flow restrictor - (maybe removed to increase flow)

PAGE FOUR

STEP THREE:

_____In the brass outlet fitting there is a flow restrictor
This is a little black bung. Shut the water off to the unit and then remove the bung from the fitting. Now replace the fitting and with the faucet open fully see if the light comes on now, with water flowing through the unit.



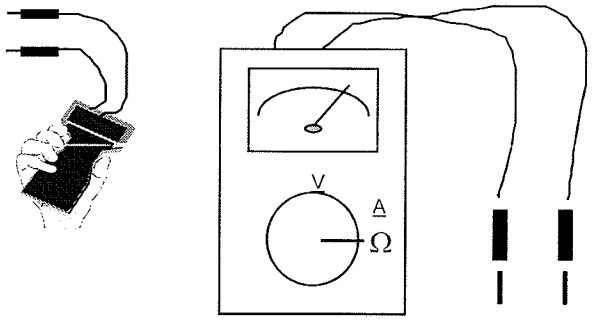
If the heater now turns "on" with water flowing, call Eemax at 1-800-543-6163. Describe what you have done and we will send you a selection of "bungs" to replace the one which you have removed. This will allow the unit to turn "on" but will also control the flow rate to give you the correct rise in temperature.

If the heater still does not work proceed to step 4.

PAGE FIVE

_____ STEP FOUR:

You will require a multimeter / voltmeter to carry out the next tests.



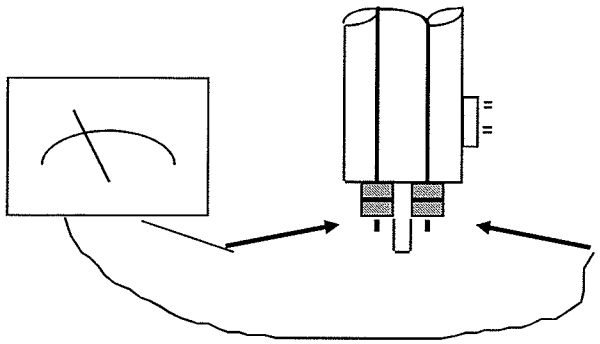
DANGER!
TURN OFF THE BREAKER BEFORE PROCEEDING WITH THE NEXT TESTS

Set the meter to the single Ohms setting
Do not measure continuity this will not work.

Ω

The Ohm symbol
(The upside down horse shoe)

Remove the heater cover, at the end of the black heater body there are two threaded silver rods with brass nuts on them. (where the wires go). Take a reading of the ohms value between these two rods.



If the reading is less than 20 ohms on the "Rx 1" scale or the "Rx 10" scale the element is good, if it is much greater e.g.... 10,000 ohms or if you get a reading on the "Rx 1K" scale then you must replace the element (contact Eemax). Tel : 1-800-543-6163 for replacement elements.

PAGE SIX

The Indicator light comes "on" but there is no heat or the water temperature is low:

STEP ONE:

_____The water flow is too high. Reduce the water flow using the faucet, with experimentation you should notice an increase in temperature. Make sure the aerator supplied with the heater is attached to the faucet, these are integral to the proper performance of your heater. If you do not have the special Eemax aerator call Eemax at 1-800-543-6163 and we will send you one.

STEP TWO:

_____Make sure that the unit is connected to the voltage supply specified on the U.L. rating label on the front cover of the heater and no other.

STEP THREE:

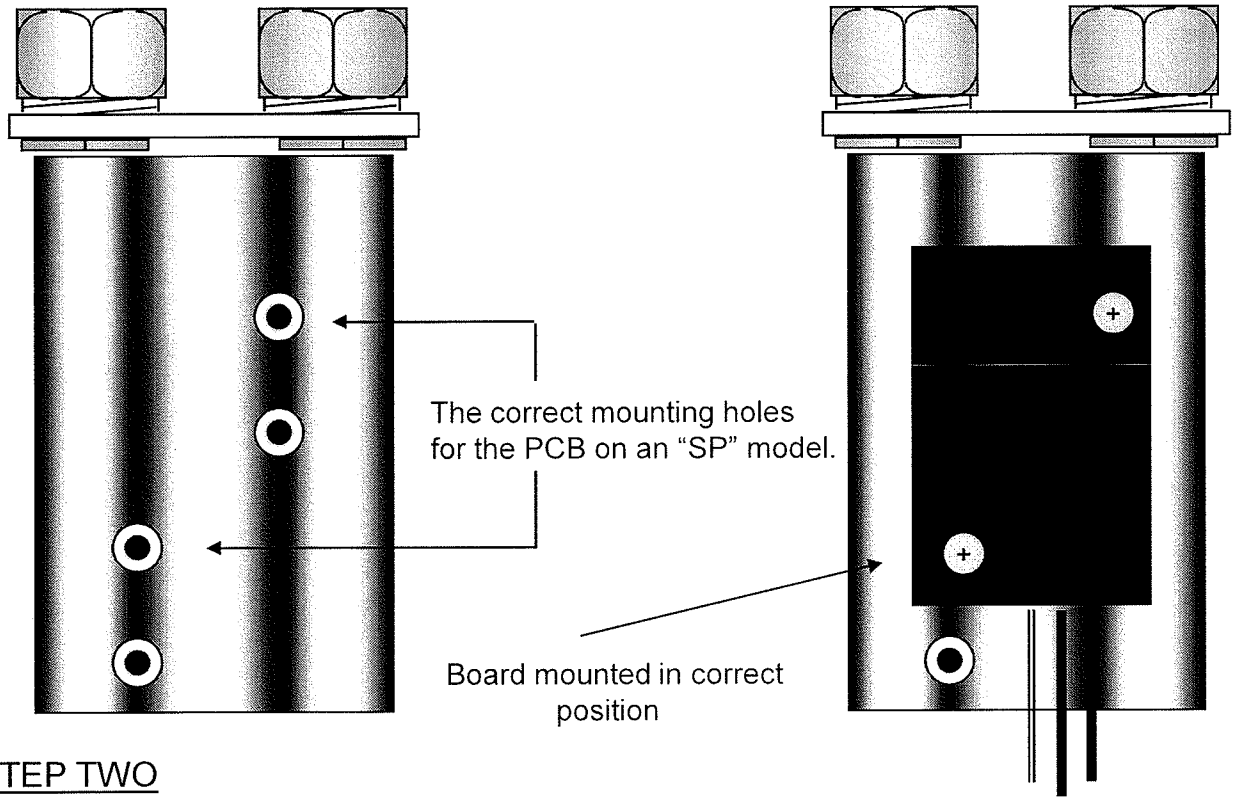
_____Take a resistance reading of the element. To do this follow instructions on page five.

PAGE SEVEN

Other possible solutions:

STEP ONE:

_____Make sure the printed circuit board is mounted in the correct position. This is the top set of mounting holes. (see diagram below). Failure to mount the board in the correct position will cause element burn out and may cause further damage to your heater. (This board may have been incorrectly moved when serviced previously.)



STEP TWO

_____Inspect the inlet filter (see diagram on page four for location). Make sure it is free from debris, pipe dope or anything else which may hinder water flow.

IF HAVING CARRIED OUT ALL THE TESTS LISTED ABOVE YOUR HEATER IS STILL NOT FUNCTIONING PLEASE CALL THE TECHNICAL SUPPORT LINE AT EEMAX : 1-800-543-6163

PLEASE HAVE THE FOLLOWING INFORMATION AVAILABLE :
1) ORDER REF. NUMBER (on U.L. rating label on the front cover of unit.)
2) SERIAL NUMBER (inside unit on backplate)

SECTION 9.1 HEATING, VENTILATION & AIR CONDITIONING

Section 9.1 Heating, Ventilation & Air Conditioning

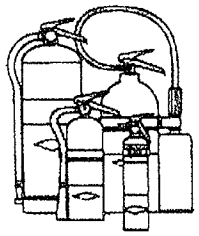
9.1.12 Fire Extinguisher

Model # WBDL-S20

Tag # NA

AMEREX

OWNER'S MANUAL
for
HAND PORTABLE
Water & Water Mist
Wet Chemical (Class K)
AFFF & FFFP Foam
Dry Chemical
Dry Powder (Class D)
Carbon Dioxide
Halotron I
Halon 1211
FIRE EXTINGUISHERS



AMEREX LIMITED 6 YEAR WARRANTY *

Amerex warrants its fire extinguishers to be free from defects in material and workmanship for a period of six (6) years from the date of purchase. During the warranty period, any such defects will be repaired or the defective extinguisher replaced IF THE ORIGINAL GREY TAMPER SEAL IS INTACT AND/OR IF ONLY FACTORY REPLACEMENT PARTS HAVE BEEN USED TO SERVICE THE EXTINGUISHER. This warranty does not cover defects resulting from modification, alteration, misuse, exposure to corrosive conditions, improper installation or maintenance.

ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO, WARRANTIES OF FITNESS FOR PURPOSE AND MERCHANTABILITY, ARE LIMITED TO THE TIME PERIODS STATED ABOVE . IN NO EVENT SHALL AMEREX CORP. BE LIABLE TO INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. Amerex Corp. neither assumes nor authorizes any representative or other person to assume for it, any obligation or liability other than expressly set forth herein. This warranty gives you specific legal right and you may have other rights, which vary from state to state. To obtain performance of the obligation of this warranty, write to Amerex Corp., P. O. Box 81, Trussville, AL 35173-0081 for instructions.

*One year warranty on HALOTRON I and HALON 1211

AMEREX CORPORATION
P.O. BOX 81
TRUSSVILLE, AL, 35173-0081
Phone: (205) 655-3271 Fax: 1-800-654-5980
e-mail: sales@amerex-fire.com
web page: www.amerex-fire.com

Printed in U.S.A. P.N. 17099 (Rev. 6/07)

INTRODUCTION

Anyone who might be expected to use this fire extinguisher should study and understand the information in this manual. Please read it completely and keep it accessible so that it may be reviewed on a periodic basis. OSHA requires training of personnel who might be expected to use an extinguisher in the case of an emergency. Familiarity with this manual and the instruction nameplate on the extinguisher will contribute to successful use of the extinguisher. You should know just what it CAN and CANNOT do, where it is located. how to use it and how to maintain it. Proper and effective use of any fire extinguisher begins with an understanding of the classes of fire. Extinguishers are tested and rated for certain classes and sizes of fires. Some are rated for single classifications, some for multiple classifications and others constitute a hazard if used on certain types of fires.

TYPES AND CLASSES OF FIRES

CLASSES OF FIRES	TYPES OF FIRES	PICTURE SYMBOL
A	Wood, paper, cloth, trash and other ordinary materials	
B	Gasoline, oil, paint and other flammable liquids	
C	May be used on fires involving live electrical equipment without danger to the operator	
D	Combustible metals and combustible metal alloys.	
K	Cooking media (Vegetable or animal oils and fats)	

IMPORTANT THINGS TO REMEMBER!

NEVER DISCHARGE A FIRE EXTINGUISHER INTO ANYONE'S FACE

NEVER THROW AN EXTINGUISHER INTO THE FIRE OR LEAVE IT UNATTENDED IF THE FIRE IS NOT OUT

(Pressure build-up could cause an explosion from even a partially full extinguisher)

KEEP FIRE EXTINGUISHERS AWAY FROM CHILDREN

Water, Water Mist and AFFF and FFFP Foam Extinguishers

The above referred to models are shipped EMPTY – they must be filled and pressurized before being placed into service.

Model 240 – To protect your investment, charge using the Amerex Model 507 Corrosion Inhibitor if your water contains more than 40 P.P.M. of chlorides.

Model 240, 250, 252, 254 – Never use involving live electrical equipment. The nameplate on the extinguishers have the international red slash across the Class C symbol designating the hazard of using them where electricity is involved.

Model B270, B272 – Water Mist Extinguishers must be charged using deionized water which contaminates. These extinguishers are UL listed for Class A and Class C fires.

Never use Water Mist, Water Type or Foam extinguishers for fires involving cooking media. The water in all could flash to steam causing extremely high temperatures and cause serious burns.

Only the Model 252 FFFP Foam may be used for fires involving water based flammable liquids such as alcohols or ketones.

DO NOT SUBJECT ANY OF THE EXTINGUISHERS IN THIS GROUP TO CONDITIONS WHERE THEY MIGHT FREEZE.

NOTE: Only the Model 240 2½ gallon water extinguisher may be chemically freeze protected to -40° F with the addition of an Amerex Model 506 charge. The 506 is not designed to protect Water Mist, Wet Chemical, AFFF or FFFP Foam extinguishers.

REVIEWED ACCORDING TO THE CONDITIONS OF THE CONTRACT AND THE GENERAL REQUIREMENTS. COMPLIANCE INDICATED IS SUBJECT TO THE REQUIREMENTS.
REVIEWED
MAKE NOTED CORRECTIONS
REVISE & RESUBMIT
DATE: 2/16/21 2016
BY:

DRY CHEMICAL, DRY POWDER (CLASS D), HALOTRON I, HALON 1211, WET CHEMICAL (CLASS K) AND CARBON DIOXIDE EXTINGUISHERS

These extinguishers are shipped factory charged. Do not test your extinguisher since even a small amount of discharge could cause it to lose pressure making it less effective or useless in case of a fire.

Dry chemicals are non-poisonous but either the acidic based (ABC) or alkaline based (Regular or Purple K) chemicals could be an irritant if inhaled. If any physical discomfort is experienced, contact a physician immediately.

Dry chemical is not recommended for fires in delicate electrical equipment or aircraft. Use of this agent may extinguish the fire but may damage the equipment beyond repair.

Neither Halotron I nor Halon 1211 should be used in confined areas smaller than indicated on the extinguisher nameplate, food preparation areas or in the presence of people with cardiac problems. If problems occur, quickly remove the person from the area where the gas is present, apply artificial respiration and transport to a physician.

Never use ABC dry chemical, Halon 1211 or Halotron I fire extinguishers on fires involving chlorine containing oxidizers (example: pool chemicals). A violent explosive reaction could occur with the mixture of chemicals.

Wet Chemical (Class K) Extinguishers are approved for use for fires involving cooking media. Do not subject these extinguishers to conditions where they might freeze.

Carbon Dioxide is discharged as a gas (with small particles of snow) at extremely low temperatures and will displace oxygen. Care should be exercised in confined areas. If problems occur, quickly remove the person from the area where the gas is present, apply artificial respiration and transport to a physician. Avoid skin contact which could cause cold burns.

NOTE: As required by OSHA, Material Safety Data Sheets (MSDS) are available for all chemicals contained in these fire extinguishers. Contact your Amerex distributor or Amerex Corporation. In addition, the MSDS information is contained in a special section of all extinguisher labels. All MSDS are available on the Amerex website at www.amerex-fire.com.

AMEREX

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Water & Water Mist
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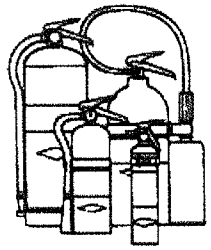

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Only the Model 252 FFFP Foam may be used for fires involving water based flammable liquids such as alcohols or ketones.

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Carbon Dioxide is discharged as a gas (with small particles of snow) at extremely low temperatures and will displace oxygen. Care should be exercised in confined areas. If problems occur, quickly remove the person from the area where the gas is present, apply artificial respiration and transport to a physician. Avoid skin contact which could cause cold burns.

NOTE: As required by OSHA, Material Safety Data Sheets (MSDS) are available for all chemicals contained in these fire extinguishers. Contact your Amerex distributor or Amerex Corporation. In addition, the MSDS information is contained in a special section of all extinguisher labels. All MSDS are available on the Amerex website at www.amerex-fire.com.

Follow the mounting instructions below, particularly in public areas where the extinguisher might be accidentally dislodged from the bracket or have objects placed on it.

MOUNTING INSTRUCTIONS

UL specifies that a hanging device must withstand a vertical force of five times the weight of the charged extinguisher but not less than 100 pounds. The extinguisher bracket should be mounted as follows:

Walls where 2"x4" studs can be found – ALL SIZES: Mount wall hanger bracket securely to stud using two #10 x 1¼" long wood screws through the diagonal smaller holes in the bracket.

Sheetrock – ALL SIZES: Mount a ¾" thick board to the wall using 3/16" toggle bolts – height and width of the board is dependent on extinguisher size. The board should extend a minimum of two inches beyond all sides of the extinguisher profile (excluding hose and horn). Mount wall hanger bracket to board using two #10 x 1" long wood screws as above.

Cinderblock or Cement – ALL SIZES: Mount wall hanger bracket using one ¼" toggle bolt or masonry lead screw expansion anchor through center hole in the bracket. Mount vehicle/marine strap type brackets using two 3/16" toggle bolts or #10 lead screw expansion anchors.

Concrete or Tile Wall – ALL SIZES – Mount wall hanger bracket using one ¼" masonry lead screw expansion anchor through center hole in wall bracket. Mount vehicle/marine strap type brackets using two No. 10 masonry lead screw expansion anchors.

Steel Posts or Beams – ALL SIZES: Special tools and fasteners are required – have extinguisher mounted by a professional fire extinguisher service company.

Tile Walls: Locate in joint.

INSPECTION

Your extinguisher should be inspected monthly, checking for any possible damage, corrosion, leakage or obstructions in the discharge outlet. The tamper seal should be unbroken. The extinguisher should be cleaned so that the instructions on the label are always clearly visible.

Carbon Dioxide extinguishers should be weighed and the weight verified to be within the tolerances specified on the nameplate (label).

Water Mist, Water, Wet Chemical, Foam, Dry chemical, Halotron I and Halon 1211 extinguisher pressure gauges should be checked. The indicator will vary slightly due to temperature, but should always be in the GREEN area if it is fully pressurized. Weigh the extinguisher to affirm that the full weight is within the tolerances stated on the nameplate.

IN CASE OF FIRE

1. Have everyone evacuate the area immediately.
2. Call the Fire Department even if the fire appears to be small (small fires quickly become LARGE fires). The Fire Dept. phone number should be posted at every phone.
3. Use your extinguisher properly, according to the instructions on the nameplate and in this manual. A large fire should be fought by professionals. Be prepared to leave the area if the fire cannot be immediately controlled.

HOW TO USE

NOTE: The following instructions are of a general nature, intended to familiarize the user with the basic operating techniques of Amerex hand portable extinguishers. **All operate by removing the ring (safety) pin and squeezing the handles together.** Since extinguishers differ, the extinguisher nameplate must be consulted for specific procedures and starting distances.

1. Hold the extinguisher upright and pull the ring (safety) pin breaking the plastic seal.
2. Stand back from the fire (the minimum distance stated on the nameplate) and aim at the base of the fire nearest you.
3. Keeping the extinguisher upright, squeeze the handles together to discharge and sweep from side to side. Move closer as the fire is extinguished but not so close as to scatter the burning metal or liquid.
4. When the fire is out, back away while watching for possible re-ignition.
5. Evacuate and ventilate the area immediately after use. The fumes and smoke from any fire may be hazardous and can be deadly.

NOTE: Whenever possible, protective clothing and breathing equipment should be used while fighting a fire.

1. HOLD EXTINGUISHER UPRIGHT AND PULL THE RING (SAFETY PIN)

2. STAND BACK FROM THE FIRE AND AIM AT THE BASE OF THE FIRE NEAREST YOU

3. SQUEEZE HANDLES TOGETHER & SWEEP THE EXTINGUISHER STREAM SIDE TO SIDE

REMEMBER THIS SIMPLE WORD – P A S S

PULL AIM SQUEEZE SWEEP

dans
ntelli

MONTHLY

INSPECTION RECORD

FASTEN TO EXTINGUISHER BEFORE INSTALLATION

DO NOT REMOVE

FOLLOW THE INSPECTION INSTRUCTIONS IN OWNER'S MANUAL AND ON THE EXTINGUISHER

Date	Inspected By	Condition

HAVE YOUR EXTINGUISHER PROFESSIONALLY MAINTAINED AND RECHARGED

RECHARGE AFTER ANY USE

IMPORTANT NOTICE TO BOAT OWNERS

If the extinguisher is to be mounted in your boat, make sure that the proper mounting bracket is used. The nameplate (in the area of the UL manifest) says if it is Coast Guard approved and the mounting bracket which MUST be used to complete the approval. You will be cited by the Coast Guard if the correct type of extinguisher and bracket has not been installed.

e gran
nel

REGISTRE D'INSPECTION MENSUELLE

À FIXER SUR L'EXTINCTEUR AVANT L'INSTALLATION

NE PAS ENLEVER

SUIVRE LES DIRECTIVES D'INSPECTION FIGURANT DANS LE MANUEL D'UTILISATION ET SUR L'EXTINCTEUR

Date	Inspecté par	État

FAIRE APPEL À UN SPÉCIALISTE POUR ENTRETENIR ET RECHARGER L'EXTINCTEUR

RECHARGER APRÈS CHAQUE UTILISATION

IMPORTANT – AVIS AUX PROPRIÉTAIRES DE BATEAUX

Si l'extincteur doit être installé dans votre bateau, veillez à utiliser un support de montage approprié. Sur la plaque signalétique de l'appareil (près de l'évaluation UL), vous trouverez des indications précisant s'il est approuvé par la Garde côtière et quel support de montage il FAUT utiliser pour qu'il soit en conformité avec cette approbation. Vous recevrez un constat d'infraction de la Garde côtière si les types d'extincteur et de support installés ne sont pas conformes.

REGISTRE D'INSPECTION
N° de modèle : _____
N° de série : _____
Date de fabrication : _____
Date - nouvelle installation : ____

INSPECTION - L'appareil doit être inspecté mensuellement ou plus fréquemment si les circonstances l'imposent. Cette inspection sert à vérifier que : 1) l'extincteur n'est pas endommagé; 2) le jet de sortie n'est pas obstrué; 3) l'appareil est bien rempli; 4) le sceau n'est pas brisé; et 5) le mode d'emploi est bien visible.

ENTRETIEN ANNUEL - C'est une inspection plus approfondie et elle doit être effectuée par un spécialiste. Elle révélera s'il est nécessaire de procéder à l'essai hydrostatique qui doit obligatoirement être effectué tous les CINQ ANS pour les extincteurs à eau ou à eau pulvérisée, à produit chimique liquide, à mousse et au dioxyde de carbone (CO_2), et tous les DOUZE ANS pour les extincteurs à produit chimique sec, à poudre, au Halotron I et au Halon 1211. La plupart des autorités locales exigent qu'une étiquette spéciale soit apposée sur l'extincteur pour confirmer ces vérifications.

ENTRETIEN à des intervalles de SIX ANS - Tous les six ans, les extincteurs nécessitant un essai hydrostatique à des intervalles de douze ans seront vidés et soumis à un examen approfondi des pièces mécaniques, des agents extincteurs et des moyens d'éjection. Quand les procédures d'entretien applicables sont mises en œuvre lors de la recharge périodique ou pendant l'essai hydrostatique, l'intervalle de six ans commencera à compter de cette date.

La RECHARGE de l'appareil après chaque utilisation doit être effectuée par un spécialiste; votre distributeur Amerex local dispose du personnel qualifié, des agents extincteurs et de l'équipement nécessaire pour la faire correctement. L'extincteur doit être rechargé à l'aide de l'agent extincteur dont le nom est indiqué sur la plaque signalétique. L'utilisation d'un produit extincteur de remplacement peut entraîner des dommages matériels ou corporels **ainsi qu'une annulation de la garantie.**

DISTRIBUÉ PAR :

INSTALLATION ET DISTRIBUTION

Procédez à l'installation, l'inspection, l'entretien et l'essai de votre extincteur conformément à la norme 10 de la NFPA (National Fire Protection Association) «concernant les extincteurs portatifs ».
L'extincteur doit être installé dans un emplacement qui est propre, sec, accessible, à proximité des endroits qui comportent des risques d'incendies et de préférence près d'une sortie. Installer l'extincteur de façon à ce que le dessus de l'appareil se trouve à une hauteur de 1 à 1,5 mètre (3,5 à 5 pieds) au-dessus du plancher et hors de la portée des petits enfants.
Utiliser le support de montage fourni avec l'appareil ou un support d'extincteur pour véhicule approuvé par Amerex s'il y a

INSPECTION RECORD
Model No: _____
Serial No: _____
Mfg. Date: _____
Date Installed New: _____

INSPECTION should be performed monthly or more frequently if circumstances dictate. The extinguisher should be checked to see that it is not damaged, the discharge outlet is not blocked, that it is fully charged, the seal is not broken and that the operating instructions are clearly visible.

ANNUAL MAINTENANCE is a more complete inspection of the extinguisher and should be done professionally. It will reveal the need for hydrotesting which must be done on Water Mist, Water, Wet Chemical, Foam and Carbon Dioxide every FIVE YEARS and Dry Chemical, Dry Powder, Halotron I and Halon 1211 extinguishers every TWELVE YEARS. Most local authorities require special tags be attached to the extinguisher to verify this service.

SIX YEAR MAINTENANCE – Every six years extinguishers requiring a 12 year hydrotest shall be emptied and subject to thorough examination of mechanical parts, extinguishing agent and expelling means. When applicable maintenance procedures are done during periodic recharging or hydrotesting, the six year requirement will begin from that date.

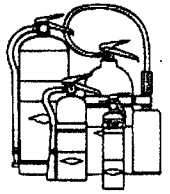
RECHARGE should be done professionally immediately after any use by your local Amerex Distributor who has the trained personnel, extinguishing agents and equipment to do it properly. This extinguisher must be recharged with the extinguishing agent specified on the nameplate. Substitutions could cause damage or injury **and will void the warranty.**

DISTRIBUTED BY:

INSTALLATION & DISTRIBUTION

Install, inspect, maintain and test your fire extinguisher in accordance with the National Fire Protection Association (NFPA) Standard No. 10 "Portable Fire Extinguishers".
Your fire extinguisher should be mounted in a clean, dry area, accessible to possible fire hazards and preferably near an exit. Mount it so that the top is from 3½ to 5 feet above the floor and out of the reach of small children.
Use the mounting bracket furnished with the extinguisher or an approved Amerex vehicle bracket if required. Fasten to a solid surface using strong screws or fasteners (not included).

MANUEL D'UTILISATION
pour
EXTINCTEURS PORTATIFS MANUELS
à eau ou à eau pulvérisée,
à produit chimique liquide (classe K)
à mousse AFFF et FFFP
à produit chimique sec
à poudre (classe D)
au dioxyde de carbone
au Halotron I
au Halon 1211



GARANTIE LIMITÉE DE 6 ANS D'AMEREX*

Amerex garantit ses extincteurs contre les vices de matériau ou de fabrication pour une période de six (6) ans à compter de la date d'achat. Au cours de cette période de garantie, les pièces présentant des défauts seront réparées ou l'extincteur défectueux sera remplacé SI LE SCEAU ORIGINAL DE FERMETURE GRIS EST ENCORE INTACT ET/OU QUE L'ON AIT SEULEMENT UTILISÉ DES PIÈCES D'ORIGINE POUR RÉPARER L'EXTINCTEUR. La présente garantie ne couvre pas les défauts dus à une modification, à un changement, à une mauvaise utilisation, à une exposition à des conditions de corrosion, à une installation ou un entretien inappropriés.
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* Garantie d'un an pour les extincteurs au HALOTRON I et au HALON 1211

AMEREX CORPORATION
P.O. BOX 81
TRUSSVILLE, AL, 35173-0081
Téléphone : (205) 655-3271 Télécopieur : 1-800-654-5980
courriel : sales@amerex-fire.com
page Web : www.amerex-fire.com
Imprimé aux États-Unis P.N. 17099 (Rév 6/07)

INTRODUCTION

Toute personne susceptible d'utiliser cet extincteur devrait étudier et comprendre l'information figurant dans le présent manuel. Veuillez lire le manuel en entier et faites en sorte qu'il reste accessible pour pouvoir être consulté de façon périodique. D'après la réglementation de l'OSHA, le personnel susceptible d'utiliser un extincteur en cas d'urgence doit recevoir une formation en conséquence. Pour bien utiliser cet extincteur, il faut se familiariser avec ce manuel et avec les instructions figurant sur la plaque signalétique de l'appareil afin de savoir quelles sont les capacités de l'extincteur, à quel endroit il est situé et comment l'utiliser ou l'entretenir. L'utilisation appropriée et efficace d'un extincteur suppose une connaissance préalable des différentes classes de feux. Les extincteurs d'incendie sont testés et cotés en fonction de la classe et de l'ampleur des feux examinés. Certains extincteurs sont adaptés à une seule classe de feux, d'autres à plusieurs et d'autres encore constituent un risque s'ils sont utilisés avec certains types de feux.

TYPES ET CLASSES DE FEUX

CLASSES DE FEUX	TYPES DE FEUX	PICTO-GRAMMES
A	Matières combustibles ordinaires (bois, papier, tissu, déchets, etc.)	
B	Liquides inflammables (essence, huiles, peintures etc.)	
C	Peut être utilisé sur les feux mettant en cause des appareils électriques sous tension sans danger pour l'opérateur	
D	Métaux et alliages combustibles	
K	Agents de cuisson (huiles et graisses végétales ou	

POINTS IMPORTANTS À NE PAS OUBLIER!

NE JAMAIS DIRIGER LE JET D'UN EXTINCTEUR SUR LE VISAGE DE QUELQU'UN

NE JAMAIS JETER UN EXTINCTEUR AU FEU NI LE LAISSER SANS SURVEILLANCE SI LE FEU N'EST PAS ÉTEINT
(Une explosion peut se produire suite à une accumulation de pression, même si l'extincteur est presque vide)

GARDER LES EXTINCTEURS HORS DE LA PORTÉE DES ENFANTS

Extincteurs à eau ou à eau pulvérisée et à mousse AFFF ou FFFP

Les modèles mentionnés ci-dessus sont livrés VIDES : ils doivent être chargés et pressurisés avant d'être mis en service.

Modèle 240 – Pour protéger votre extincteur, chargez-le à l'aide de l'inhibiteur de corrosion du modèle 507 d'Amerex si la concentration des chlorures dans l'eau est supérieure à 40 ppm.

Modèles 240, 250, 252, 254 – Ne jamais utiliser ces extincteurs avec des appareils électriques sous tension. Le C (symbole de la classe) barré d'une croix rouge signale le danger de les utiliser sur les feux d'origine électrique.

Modèles B270, B272 – Les extincteurs à eau pulvérisée doivent être chargés avec de l'eau déionisée pour éviter toute contamination. Ces extincteurs sont homologués UL pour les **feux de classes A et C.**

Ne jamais utiliser d'extincteurs à eau pulvérisée, à eau et à mousse AFFF ou FFFP pour les feux mettant en cause des agents de cuisson. La vaporisation instantanée de l'eau susceptible de se produire en raison des températures extrêmement élevées peut provoquer de graves brûlures.

Seul le modèle 252 à mousse FFFP peut être utilisé sur les feux mettant en cause des liquides inflammables solubles dans l'eau comme les alcools ou les cétones.

NE PAS EXPOSER AU GEL LES EXTINCTEURS APPARTENANT À CE GROUPE.

REMARQUE : Seul le modèle 240 d'extincteur à eau muni d'un réservoir de 2½ gallons (9,5 litres) peut être doté d'une protection antigel jusqu'à -40 °C (-40 °F) avec l'ajout d'une charge du modèle 506 d'Amerex. En revanche, le modèle 506 n'est pas conçu pour protéger du gel les extincteurs à eau pulvérisée, à produit chimique humide ou à mousse AFFF et FFFP.

EXTINCTEURS À PRODUIT CHIMIQUE SEC, À POUDRE (CLASSE D), AU HALOTRON I, AU HALON 1211, À PRODUIT CHIMIQUE LIQUIDE (CLASSE K) ET À DIOXYDE DE CARBONE

Ces extincteurs sont remplis au départ de l'usine. **Ne testez pas votre extincteur**, car une décharge du produit si petite soit-elle peut entraîner une perte de pression et rendre l'appareil moins efficace, voire inutile en cas d'incendie.

Les produits chimiques secs ne sont pas toxiques, mais les produits chimiques acides (ABC) ou alcalins (produits ordinaires ou la poudre extinctrice « Purple K») peuvent être irritants pour les voies respiratoires. Au premier indice d'inconfort physique, communiquez immédiatement avec un médecin.

Il est déconseillé d'utiliser un produit chimique sec sur les feux prenant naissance dans un appareil électrique délicat ou un aéronef. Cet agent extincteur est peut-être efficace, mais il peut aussi irrémédiablement endommager l'équipement concerné.

Le Halotron I et le Halon 1211 ne doivent pas être utilisés dans des espaces clos plus exigus que ceux mentionnés sur la plaque signalétique de l'extincteur, dans les aires de préparation des aliments ou en présence de personnes souffrant de troubles cardiaques. Si une personne éprouve un malaise, faites-la rapidement sortir de la zone où le gaz est présent, pratiquez la respiration artificielle et conduisez la personne chez un médecin.

Ne jamais utiliser d'extincteurs à produit chimique sec ABC, au Halon 1211 ou au Halotron I sur des feux mettant en cause du chlore renfermant des oxydants (exemple : produits chimiques utilisées pour piscine). Le mélange de ces produits chimiques peut par réaction déclencher une violente explosion.

Les extincteurs à produit chimique liquide (de classe K) sont cotés pour éteindre les feux mettant en cause des agents de cuisson. Évitez d'exposer ces extincteurs au gel.

Le dioxyde de carbone (CO^2) est relâché à l'état de gaz (avec de petites particules de « neige carbonique ») à des températures extrêmement froide ce qui a pour effet de diminuer la teneur en oxygène. Il faut être prudent dans les espaces clos. Si une personne éprouve un malaise, faites-la rapidement sortir de la zone où le gaz est présent, pratiquez la respiration artificielle conduisez la personne chez un médecin. Évitez tout contact avec la peau qui pourrait provoquer des gelures.

REMARQUE : Conformément aux exigences de l'OSHA, des fiches signalétiques (FS) sont disponibles pour tous les produits chimiques contenus dans ces extincteurs. Communiquez avec votre distributeur ou avec Amerex Corporation. En outre, l'information figurant sur les fiches signalétiques se retrouve également dans une section réservée à cet effet sur toutes les étiquettes des extincteurs. Toutes ces fiches signalétiques sont disponibles sur le site Web d'Amerex à www.amerex-fire.com.

Suivre les directives d'installation ci-dessous, surtout si l'extincteur est installé dans un endroit très passant où il peut être accidentellement délogé de son support ou servir à suspendre des objets.

DIRECTIVES D'INSTALLATION

Selon l'Underwriters Laboratory (UL) un dispositif suspendu doit être en mesure de résister à une force verticale qui est soit égale à cinq fois le poids de l'extincteur rempli soit égale à au moins 45,4 kg (100 livres). Le support de l'extincteur doit être fixé comme suit: :

Murs comprenant des montants de 5 cm x 10 cm (2 po x 4 po) - TOUTES DIMENSIONS : Bien fixer le support mural au montant par deux vis en bois n° 10 de 31 mm (1¼ po) de long passant par les petits trous diagonaux du support.

Panneau de plâtre - TOUTES DIMENSIONS : Fixer un panneau de 1,9 cm (¾ po) d'épaisseur au mur au moyen de boulons à ailettes de 5 mm (3/16 po); la hauteur et la largeur du panneau dépendent des dimensions de l'extincteur. Le panneau doit dépasser d'au moins deux pouces les côtés de l'extincteur (à l'exclusion du tuyau et du cône). Fixer le support mural sur le panneau à l'aide de deux vis en bois n° 10 de 25 mm (1 po) de long comme ci-dessus.

Bloc de béton ou ciment - TOUTES DIMENSIONS : Fixer le support mural au moyen d'un boulon à ailettes de 6 mm (¼ po) ou d'un ancrage pour vis sans fin de maçonnerie passant par le trou au centre du support. Fixer les supports de type « ceinture de sécurité » pour véhicule ou embarcation au moyen de deux boulons à ailettes de 5 mm (3/16 po) ou d'ancrages pour vis sans fin n° 10.

Mur en béton ou en carrelage - TOUTES DIMENSIONS : Fixer le support mural au moyen d'un ancrage pour vis sans fin de maçonnerie de 6 mm (¼ po) passant par le trou au centre du support. Fixer les supports de type « ceinture de sécurité » pour véhicule ou embarcation au moyen de deux ancrages pour vis sans fin n° 10.

Poteau ou poutre en acier - TOUTES DIMENSIONS : Comme cette installation nécessite des attaches et des outils spéciaux, il faut dans ce cas faire installer l'extincteur par une entreprise de service spécialisée dans les extincteurs d'incendie.

Mur en carrelage : Posez l'appareil sur un joint.

INSPECTION

Votre extincteur doit être inspecté tous les mois pour vérifier s'il y a des signes de dégradation, de corrosion, de fuite ou d'obstruction possible des jets de sortie. Le sceau ne doit pas être brisé. L'extincteur doit, en outre, être nettoyé afin que les instructions figurant sur l'étiquette soient toujours bien visibles. Les extincteurs au **dioxyde de carbone** doivent être pesés pour vérifier si leur poids est conforme aux limites de tolérance indiquées sur la plaque signalétique (étiquette).

Il faut vérifier les manomètres de pression des extincteurs **à eau ou à eau pulvérisée, à produit chimique liquide, à mousse, à produit chimique sec, à poudre, au Halotron I et au Halon 1211.** L'indicateur de pression variera légèrement en fonction de la température, mais il doit toujours rester dans la zone VERTE s'il est à la pression d'utilisation. Soulever ou peser l'appareil pour voir s'il est vraiment plein.

EN CAS D'INCENDIE

1. Faites en sorte que tout le monde évacue immédiatement les lieux.
2. Appelez le service d'incendie, même s'il semble s'agir d'un feu de faible ampleur (un incendie mineur peut devenir très vite un incendie MAJEUR). Le numéro de téléphone des pompiers doit être affiché sur chaque téléphone.
3. Utilisez l'extincteur comme il convient, en suivant les directives figurant sur la plaque signalétique et dans ce manuel. Un feu de grande ampleur doit être combattu par des professionnels. Soyez prêt à quitter les lieux si l'incendie ne peut pas être immédiatement maîtrisé.

COMMENT UTILISER UN EXTINCTEUR

REMARQUE : Les instructions suivantes sont d'ordre général et ont pour objet de familiariser l'utilisateur avec les techniques de fonctionnement de base des extincteurs portatifs manuels d'Amerex. **Ils sont tous activés de la même manière : en enlevant la goupille de (sécurité) et en serrant les poignées.** En raison de la diversité des extincteurs, il faut consulter la plaque signalétique de chaque appareil pour connaître la marche à suivre et les distances d'attaque du feu.

1. Tenez l'extincteur droit et tirez la goupille de (sécurité) en brisant le sceau en plastique.
2. Écartez-vous du feu (à la distance minimale indiquée sur la plaque signalétique) et visez la base des flammes les plus proches de vous.
3. En tenant toujours l'appareil en position verticale, serrez les poignées pour relâcher son contenu en effectuant un mouvement de balayage horizontal. Avancez à mesure que le feu s'éteint mais sans trop vous rapprocher: vous éviterez ainsi de disperser les matières ou liquides brûlants.
4. Lorsque le feu semble éteint, reculez tout en le surveillant pour voir s'il reprend.
5. Évacuez et aérez immédiatement la zone après utilisation : les vapeurs et la fumée dégagées par un feu risquent d'être dangereuses, voire mortelles.

REMARQUE : En combattant un incendie, porter si possible, des vêtements de protection et un masque respiratoire.

1. TENIR L'EXTINCTEUR DROIT ET TIRER LA GOUPILLE DE (SÉCURITÉ)

2. EN RESTANT À L'ÉCART DU FEU, VISER LA BASE DES FLAMMES LES PLUS PROCHES DE VOUS

3. SERRER LES POIGNÉES ET IMPRIMER UN MOUVEMENT DE BALAYAGE HORIZONTAL AU JET DE L'EXTINCTEUR

DES LETTRES À NE PAS OUBLIER : TV et PB

TIRER VISER PRESSER BALAYER

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SECTION 9.2 ELECTRICAL

Section 9.2 Electrical

9.2.1 Kohler Standby Generator

Model # 40REOZJB

Tag # na

Operation

Industrial Generator Sets

Models:

20–2250 kW

Controllers:
Decision-Maker™ 3+, 16-Light
Software (Code) Version 1.10 or higher
Decision-Maker™ 1

SHOP DRAWING REVIEW
THIS DRAWING HAS BEEN REVIEWED FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT ONLY. SUCH REVIEW SHALL NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY FOR ERRORS OR OMISSIONS OR OF MEETING THE REQUIREMENTS OF THE CONTRACT DOCUMENTS. NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS OF DIMENSIONS OR DETAILS.
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AMEND & RESUBMIT
REJECTED
Project No. 088932-4040
By MCL
Date May 27/09
DILLON CONSULTING LIMITED

ISO 9001
KOHLER POWER SYSTEMS
NATIONALLY REGISTERED

KOHLER®
POWER SYSTEMS

TP-6161 1/08f

California Proposition 65

⚠ WARNING

Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Product Identification Information

Product identification numbers determine service parts. Record the product identification numbers in the spaces below immediately after unpacking the products so that the numbers are readily available for future reference. Record field-installed kit numbers after installing the kits.

Generator Set Identification Numbers

Record the product identification numbers from the generator set nameplate(s).

Model Designation _____

Specification Number _____

Serial Number _____

Accessory Number	Accessory Description

Controller Identification

Record the controller description from the generator set operation manual, spec sheet, or sales invoice.

Controller Description _____

Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer _____

Model Designation _____

Serial Number _____

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IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. SAVE THESE INSTRUCTIONS.

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

DANGER

Danger indicates the presence of a hazard that ***will cause severe personal injury, death***, or ***substantial property damage***.

WARNING

Warning indicates the presence of a hazard that ***can cause severe personal injury, death,*** or ***substantial property damage***.

CAUTION

Caution indicates the presence of a hazard that ***will*** or ***can cause minor personal injury*** or ***property damage***.

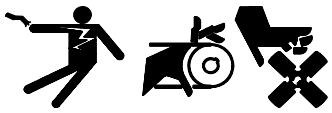
NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Battery

WARNING

Sulfuric acid in batteries.
Can cause severe injury or death.

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

WARNING

Explosion.
Can cause severe injury or death.
Relays in the battery charger cause arcs or sparks.

Locate the battery in a well-ventilated area. Isolate the battery charger from explosive fumes.

Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

Engine Backfire/Flash Fire

⚠ WARNING

Fire.
Can cause severe injury or death.

Do not smoke or permit flames or sparks near fuels or the fuel system.

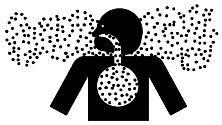
Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or carburetor.

Servicing the air cleaner. A sudden backfire can cause severe injury or death. Do not operate the generator set with the air cleaner removed.

Combustible materials. A fire can cause severe injury or death. Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

Exhaust System

⚠ WARNING



Carbon monoxide.
Can cause severe nausea, fainting, or death.

The exhaust system must be leakproof and routinely inspected.

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate the generator set where exhaust gas could accumulate and seep back inside a potentially occupied building.

Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

Fuel System

⚠ WARNING

Explosive fuel vapors.
Can cause severe injury or death.

Use extreme care when handling, storing, and using fuels.

The fuel system. Explosive fuel vapors can cause severe injury or death. Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel

leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

Explosive fuel vapors can cause severe injury or death. Take additional precautions when using the following fuels:

Gasoline—Store gasoline only in approved red containers clearly marked GASOLINE.

Propane (LP)—Adequate ventilation is mandatory. Because propane is heavier than air, install propane gas detectors low in a room. Inspect the detectors per the manufacturer's instructions.

Natural Gas—Adequate ventilation is mandatory. Because natural gas rises, install natural gas detectors high in a room. Inspect the detectors per the manufacturer's instructions.

Fuel tanks. Explosive fuel vapors can cause severe injury or death. Gasoline and other volatile fuels stored in day tanks or subbase fuel tanks can cause an explosion. Store only diesel fuel in tanks.

Draining the fuel system. Explosive fuel vapors can cause severe injury or death. Spilled fuel can cause an explosion. Use a container to catch fuel when draining the fuel system. Wipe up spilled fuel after draining the system.

Gas fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LP vapor gas or natural gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to 6–8 ounces per square inch (10–14 inches water column). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

LP liquid withdrawal fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LP liquid withdrawal gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to at least 90 psi (621 kPa). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

Hazardous Noise

⚠ CAUTION

Hazardous noise.
Can cause hearing loss.

Never operate the generator set without a muffler or with a faulty exhaust system.

Engine noise. Hazardous noise can cause hearing loss. Generator sets not equipped with sound enclosures can produce noise levels greater than 105 dBA. Prolonged exposure to noise levels greater than 85 dBA can cause permanent hearing loss. Wear hearing protection when near an operating generator set.

Hazardous Voltage/ Moving Parts

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ WARNING

Hazardous voltage. Moving parts.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

⚠ WARNING

Hazardous voltage.
Backfeed to the utility system can cause property damage, severe injury, or death.

If the generator set is used for standby power, install an automatic transfer switch to prevent inadvertent interconnection of standby and normal sources of supply.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Installing the battery charger. Hazardous voltage can cause severe injury or death. An ungrounded battery charger may cause electrical shock. Connect the battery charger enclosure to the ground of a permanent wiring system. As an alternative, install an equipment grounding conductor with circuit conductors and connect it to the equipment grounding terminal or the lead on the battery charger. Install the battery charger as prescribed in the equipment manual. Install the battery charger in compliance with local codes and ordinances.

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Engine block heater. Hazardous voltage can cause severe injury or death. The engine block heater can cause electrical shock. Remove the engine block heater plug from the electrical outlet before working on the block heater electrical connections.

Handling the capacitor. Hazardous voltage can cause severe injury or death. Electrical shock results from touching the charged capacitor terminals. Discharge the capacitor by shorting the terminals together.
(Capacitor-excited models only)

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Install a transfer switch in standby power installations to prevent the connection of standby and other sources of power. Electrical backfeed into a utility electrical system can cause severe injury or death to utility personnel working on power lines.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

⚠ WARNING

Airborne particles.
Can cause severe injury or blindness.

Wear protective goggles and clothing when using power tools, hand tools, or compressed air.

Servicing the generator set when it is operating. Exposed moving parts can cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

Heavy Equipment

⚠ WARNING

Unbalanced weight.
Improper lifting can cause severe injury or death and equipment damage.

Do not use lifting eyes.
Lift the generator set using lifting bars inserted through the lifting holes on the skid.

Hot Parts

⚠ WARNING

Hot coolant and steam.
Can cause severe injury or death.

Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.

⚠ WARNING

Hot engine and exhaust system.
Can cause severe injury or death.

Do not work on the generator set until it cools.

Servicing the alternator. Hot parts can cause severe injury or death. Avoid touching the alternator field or exciter armature. When shorted, the alternator field and exciter armature become hot enough to cause severe burns.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

Notice

NOTICE

This generator set has been rewired from its nameplate voltage to

246242

NOTICE

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/dealer.

NOTICE

Canadian installations only. For standby service connect the output of the generator set to a suitably rated transfer switch in accordance with Canadian Electrical Code, Part 1.

This manual provides operation instructions for 20–2250 kW generator sets equipped with the following controllers:

- Decision-Maker™ 3+, 16-Light
- Decision-Maker™ 1

Wiring diagram manuals are available separately. Refer to the engine operation manual for generator set engine scheduled maintenance information.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with the equipment for future reference.

The equipment service requirements are very important to safe and efficient operation. Inspect the parts often and perform required service at the prescribed intervals. Maintenance work must be performed by appropriately skilled and suitably trained maintenance personnel familiar with generator set operation and service.

Abbreviations

This publication makes use of numerous abbreviations. Typically, the word(s) are spelled out along with the abbreviation in parentheses when shown for the first time in a section. Appendix A, Abbreviations, also includes many abbreviation definitions.

List of Related Materials

Separate literature contains communication and software information for the 16-Light Controller with communications not provided in this manual. Figure 1 lists the available literature part numbers.

Communication and Software Manual Description	Literature Part No.
16-Light Controller Spec Sheet	G6-30
Decision-Maker™ 1 Controller Spec Sheet	G6-29
Generator Set/Controller Wiring Diagram Manual	Multiple Part Numbers Contact your Distributor/Dealer
Modbus® Communications Protocol Operation Manual	TP-6113
Service Parts Controllers	TP-6009
Program Loader Software Installation	TT-1285
Remote Serial Annunciator (RSA)	TT-1377
Controller Service Replacement	TT-1310
Monitor III Converters, Connections, and Controller Setup	TT-1405
Monitor III Software Spec Sheet	G6-76
Monitor III Converter, Modbus®/Ethernet Spec Sheet	G6-79
Monitor III Software Operation Manual	TP-6347

Figure 1 Related Literature

Several engine manufacturers provide engines with electronic controls. These electronic controls indicate fault codes in addition to the generator set controller. Use Figure 2 for literature part numbers relating to the identifying engine fault codes. For the latest literature part numbers, see the respective Parts Catalog.

Model	Literature Part No.	Description
30 kW and 80–125 kW GM	TP-6215	Engine ECM Service Manual
80–200 kW John Deere 4045/6068	TP-6285	Engine Operation Manual
275–500 kW Kohler Branded Engines	TP-6218	Engine Operation Manual
135–275 kW DDC Series 50/60 Gas	TP-5830	Natural Gas Generator Set Engine Operator's Guide
230–450 kW DDC Series 60	TP-6056	DDEC IV Application and Installation Manual
230–450 kW DDC Series 60	TP-5611	Engine Operator's Guide
450/500 kW DDC Series 2000	TP-6361	DDEC IV ECM Troubleshooting Guide
650–1000 kW DDC Series 2000	TP-6375	Engine Operating Instructions (MDEC)
650–1000 kW DDC/MTU Series 2000	TP-6502	Engine Operating Instructions (ADEC)
1250–2250 kW DDC/MTU Series 4000	TP-6503	Engine Operating Instructions (ADEC)
1350–2000 kW DDC/MTU Series 4000	TP-6237	Engine Operating Instructions (MDEC)

Figure 2 Related Engine Literature

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Tech Tools

Use your SecurID to access the KOHLERnet and click on Tech Tools button to find the following topics:

- **Software** used by generator set controllers including updates and documentation references.
- **Network Communications** provides basics to terms, protocols, standards, wiring, configurations, and model.
- **Engine Electronic Control Module (ECM)** has information about electronic devices provided by the engine manufacturer to manage engine data.

Service Assistance

For professional advice on generator set power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Consult the Yellow Pages under the heading Generators—Electric.
- Visit the Kohler Power Systems website at KohlerPower.com.
- Look at the labels and stickers on your Kohler product or review the appropriate literature or documents included with the product.
- Call toll free in the US and Canada 1-800-544-2444.
- Outside the US and Canada, call the nearest regional office.

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East China Regional Office, Shanghai
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India, Bangladesh, Sri Lanka
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Bangalore, India
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Fax: (91) 80 3315972

Japan, Korea
North Asia Regional Office
Tokyo, Japan
Phone: (813) 3440-4515
Fax: (813) 3440-2727

Latin America
Latin America Regional Office
Lakeland, Florida, USA
Phone: (863) 619-7568
Fax: (863) 701-7131

1.1 Introduction

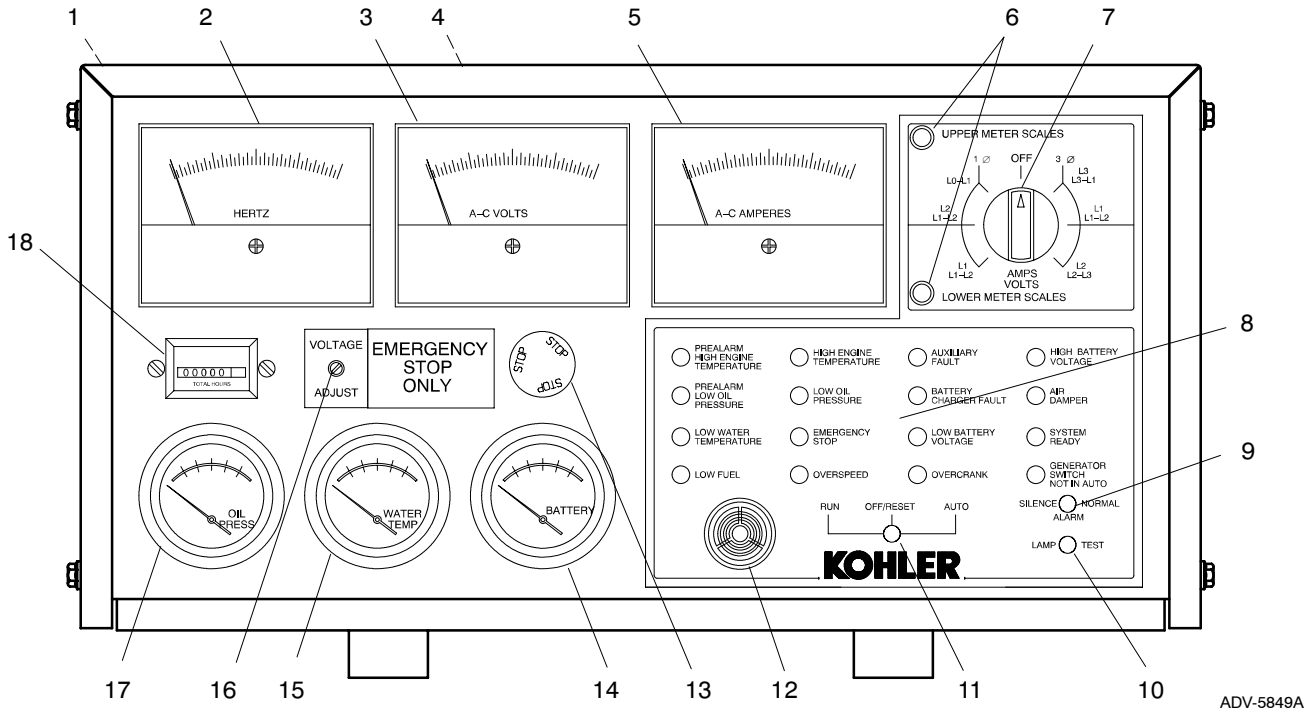
The specification sheets for each generator set provide specific generator and engine information. Refer to the respective specification sheet for data not supplied in this manual. Consult the generator set service manual, installation manual, engine operation manual, and engine service manual for additional specifications.

1.2 16-Light Controller Features

The 16-light controller can operate in either the normal mode or the prime power mode. The prime power mode allows reduced controller current draw in applications without a battery charger, minimizing battery drain by the controller circuitry. See Section 2.3.2, Prime Power Mode Operation, for more information.

Figure 1-1 shows the 16-light (level 1) controller. The 16-light controller features include annunciator panel lamps, analog meters, switches and controls, and fuses and terminal strips. For identification and an explanation of the functions, see Sections 1.2.1 through 1.2.7.

Note: Some installations use modified 16-light microprocessor controllers with switchgear applications. These nonstandard controllers may have remote start and no time delay for engine cooldown circuitry. Consult the switchgear literature for configuration and function.



1. Fuses (inside controller)
2. Frequency meter
3. AC voltmeter
4. Controller TB1 and TP2 terminal strips (on circuit board)
5. AC ammeter
6. Scale lamps (upper/lower)
7. Selector switch
8. Annunciator panel lamps
9. Alarm silence switch
10. Lamp test
11. Generator set master switch
12. Alarm horn
13. Emergency stop switch (if equipped)
14. DC voltmeter
15. Water temperature gauge
16. Voltage adjustment (if equipped)
17. Oil pressure gauge
18. Hourmeter

Figure 1-1 16-Light Decision-Maker 3+™ Controller

The 16-light controller with communications has a new circuit board GM28725 that is different in appearance and has additional functions from the earlier versions but is a **direct replacement for earlier version circuit boards including A-336415**. Features of the new circuit board include the following items:

- Red circuit board, previous versions are green.
- Terminal strips (TB1, TB2, and TB3).
- SW1 DIP switch (8 switches).
- Communication connector P21 for Modbus® to download new application program software or to connect the remote serial annunciator using RS-485 communications. Requires RS-485 to RS-232 converter for downloading application program.
- Communication connector P22 for J1939 engine communication.

New Application Program Software. Contact your local authorized distributor for application program updates when instructed to do so during troubleshooting and/or when adding specific accessories. Refer to TT-1285 Program Loader Software instruction for additional download information.

1.2.1 Annunciator Panel Lamps

Figure 1-2 lists the annunciator lamps included on each controller and describes the lamp functions.

Lamp	Description
Air damper	This light is not used on current standard products.
Auxiliary fault	Flashes or lights upon fault detection. Figure 1-3 describes auxiliary fault conditions.
High engine temperature	Lights if the engine has shut down because of high engine temperature. The shutdown occurs 5 seconds after the engine reaches temperature shutdown range.
Low oil pressure	Lamp lights if the generator set shuts down because of insufficient oil pressure. The shutdown occurs 5 seconds after the engine reaches temperature shutdown range.
Overspeed	Lamp lights if the generator set shuts down because the governed frequency on 50/60 Hz models exceeds 60/70 Hz.
Overcrank	Cranking stops and the lamp lights if the engine does not start after 30 seconds of continuous cranking or 75 seconds of cyclic cranking. See Section 2.3.1, Normal Operation. **Note:** The engine ECM may limit the crank cycle even if the controller is set to a longer time period. Cranking stops and the overcrank lamp lights after 25 seconds if the starter or engine does not turn (locked rotor). The overcrank lamp flashes if the speed sensor signal is absent for longer than one second.
Low water temperature	Lights if water temperature falls below the minimum preset temperature. This lamp may require an optional prealarm sender kit in order to function.
Battery charger fault	Lights if the battery charger malfunctions. This lamp requires an optional battery charger.
Emergency stop	Lights and the generator set shuts down if the optional emergency stop switch is energized either locally or from a remote location. The local emergency stop switch is standard on selected models.
Generator switch not in auto	Lights when the generator set master switch is in the RUN or OFF/RESET position.
High battery voltage	Lights if the battery voltage rises above preset level. An optional battery charger is required for the lamp to function.
Low battery voltage	Lights if the battery voltage drops below a preset level. This lamp requires an optional battery charger in order for the lamp to function.
Low fuel warning	Lights if the fuel level in tank approaches empty. This lamp requires a low fuel sensor in the fuel tank in order to function. On gas-fueled systems, this lamp lights if the gas line pressure drops below a preset level.
Prealarm high engine temperature	Lights if the engine temperature approaches the shutdown range. This lamp may require an optional prealarm sender kit.
Prealarm low oil pressure	Lights if the engine oil pressure approaches the shutdown range. This lamp may require an optional prealarm sender kit in order to function.
System ready	Lights when the generator set master switch is in the AUTO position and the system senses no faults. Indicates that the generator set is ready for operation.

Figure 1-2 Annunciator Panel Lamps

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1.2.2 Auxiliary Fault Lamp

The auxiliary fault lamp flashes or lights continuously to indicate different conditions. Figure 1-3 describes the auxiliary fault lamp conditions.

Generator Condition	Lamp Illumination	
	Flashing	Continuous
Auxiliary Delay Shutdown. Lamp lights and the engine shuts down 5 seconds after high oil temperature (P1-13), low coolant level (P1-10 [2-wire sender] or P1-14 [3-wire switch]), or auxiliary delay shutdown (P1-15) faults (if equipped) occur. These fault conditions are inhibited during the first 30 seconds after crank disconnect.		X
Auxiliary Immediate Shutdown. Lamp lights and the engine shuts down if activated by customer-supplied sensing devices connected to auxiliary immediate shutdown ports (P1-17 and P1-18).		X
Emergency Stop Switch Reset. Lamp lights if the optional emergency stop switch is reset while the generator set master switch is in the AUTO or RUN position. Place the generator set master switch in the OFF/RESET position to clear this fault.		X
Low Fuel Shutdown (125RZG only). Lamp lights and the engine shuts down if activated by the low fuel pressure shutdown switch connected to the **Auxiliary Immediate Shutdown** port P1-17. Place the generator set master switch in the OFF/RESET position to clear this fault.		X
No AC Output. Lamp flashes if the controller senses no AC output with the unit running (except during first 10 seconds after startup). When the controller senses AC output, the flashing stops and the lamp is unlit. Does not require manual reset.	X	
Overvoltage Shutdown. Lamp lights and the engine shuts down immediately if an overvoltage condition arises (if equipped with overvoltage shutdown kit).		X
Underfrequency Shutdown. Lamp lights and the engine shuts down if the engine speed drops below 5% of the nominal engine speed (1710 for 1800 rpm or 1425 for 1500 rpm) for a continuous 60-second period.		X

Figure 1-3 Auxiliary Fault Lamp Operation

1.2.3 Fuses

The fuses listed in Figure 1-4 protect the generator set circuitry.

Fuse	Description
F1	3-amp remote annunciator fuse protects the dry contact kit (if equipped).
F2	3-amp controller fuse protects the controller circuit board, speed sensor, and lamp circuit board.
F3	15-amp engine and accessories fuse protects engine/starting circuitry and accessories.

Figure 1-4 Controller Fuses

1.2.4 Analog Meters and Gauges

Figure 1-5 describes the meters and gauges located on microprocessor controllers.

Name	Description
AC voltmeter	Meter displays the AC output voltage. Use the selector switch to choose the output lead circuits.
AC ammeter	Meter displays the AC output amperage. Use the selector switch to choose the phase currents.
DC voltmeter	Meter displays the voltage of the starting battery(ies).
Frequency meter	Meter displays the frequency (Hz) of the generator set output.
Hourmeter	Hourmeter records the generator set total operating hours for reference in maintenance scheduling.
Oil pressure gauge	Gauge measures the engine oil pressure.
Scale lamps (upper/lower)	Lamps indicate which AC voltmeter and/or ammeter scales to read.
Water temperature gauge	Gauge displays the engine coolant temperature.

Figure 1-5 Analog Meters and Gauges

1.2.5 Switches and Controls

Figure 1-6 describes the switches and controls located on microprocessor controllers.

Name	Description
Alarm horn	Horn sounds if any fault or prealarm condition exists (except emergency stop, battery charger fault, high battery voltage, or low battery voltage). Place the generator set master switch in the AUTO position before silencing the alarm horn. See controller resetting procedure in Section 2.3.5, Controller Resetting After a Fault Shutdown.
Alarm silence switch	Switch silences the alarm during service. Place the generator set master switch in the AUTO position before silencing the alarm horn. To avoid reactivating the alarm horn, restore all alarm horn switches (controller, remote annunciator, and audiovisual alarm) to their normal positions after correcting the fault. See controller resetting procedure in Section 2.3.5, Controller Resetting After a Fault Shutdown.
Emergency stop switch	Switch (if equipped) immediately shuts down the generator set in emergency situations. Reset the emergency stop switch after shutdown by pulling the knob slightly outward. Use the emergency stop switch for emergency shutdowns only. Use the generator set master switch for normal shutdowns. The local emergency stop switch is standard on selected generator sets.
Generator set master switch	Switch functions as the controller reset and generator set operation switch. Refer to Section 2.3.1, Normal Operation, Section 2.3.2, Prime Power Mode Operation, and Section 2.3.5, Controller Resetting After a Fault Shutdown.
Lamp test switch	Switch displays the controller indicator lamps.
Selector switch	Switch selects the generator set output circuits to measure. When switched to a position with three circuit labels, the meters display the amperage on the lead shown in the upper label and the voltage between the two leads shown in the lower label. The AC ammeter and voltmeter function only with the switch in the ON position.
Voltage adjustment control, if equipped	Control fine tunes (±5%) the generator set output voltage. Used with 20–400 kW permanent magnet/wound field alternator models only. The voltage adjustment on 350–2000 kW pilot-excited models is located in the generator junction box.

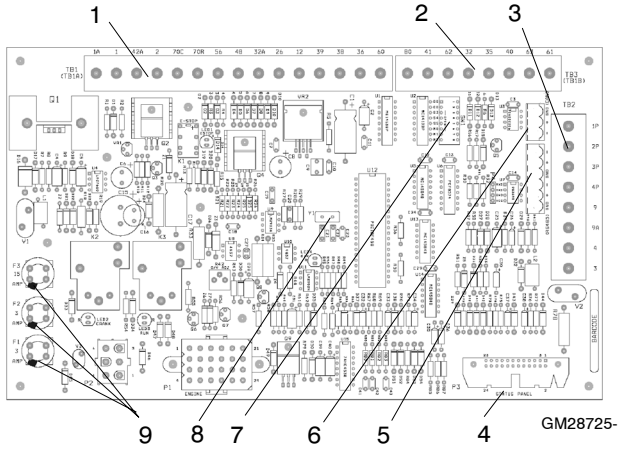
Figure 1-6 Switches and Controls

1.2.6 Terminal Strips

Two terminal strips are mounted on the controller circuit board. See Figure 1-7 and Figure 1-8. Refer to Section 2.3.2, Prime Power Mode Operation, for information on enabling prime power mode.

Terminal Strip	Description
TB1/TB3	Terminal strip for connecting generator set accessories such as an emergency stop switch, a remote start/stop switch, audiovisual alarms, etc. Refer to the wiring diagrams for information on connecting accessories to the TB1 terminal strip.
TB2	Terminal strip for selecting the remote start/stop switch inputs and prime power mode.
P3/P7	Communication module connection for remote serial annunciator (RSA) or network communication.
P21	RS-485 communication connection for Modbus® to download new application program software or for connecting the remote serial annunciator.
P22	CAN (engine) communication connection.

Figure 1-7 Controller Terminal Strips/Connections



1. TB1 (TB1A) terminal strip
2. TB3 (TB1B) terminal strip
3. TB2 terminal strip
4. P3 annunciator panel lamp and RSA communication module connections
5. P21 for Modbus® RS-485 communication connection
6. P22 for CAN (engine) communication connection
7. SW1 DIP switch (8 positions)
8. P7 RSA communication module connection
9. Fuses

Figure 1-8 Controller DIP Switches

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1.2.7 DIP Switches

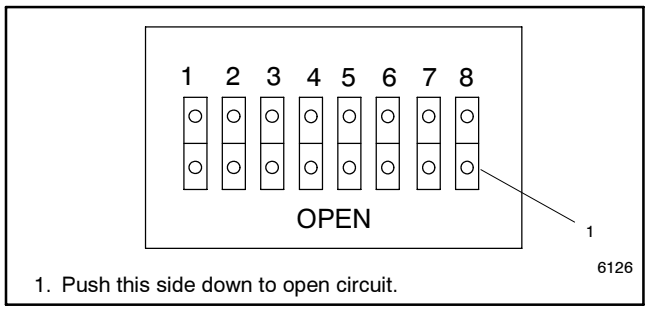
The controller circuit board contains eight DIP switches, see Figure 1-9.

DIP Switch	Description	Switch Position	
		Open	Closed
1	Overspeed selection	60 Hz	70 Hz
2	Temperature Cooldown Enable	Cooldown Disabled	Cooldown Functional
3	Crank Mode Selection	Cyclic	Continuous
4	Engine Comm. Setting	See selections for DIP switch 4 and DIP switch 5 below	
5	Engine Comm. Setting		
6	Modbus® Address Bit 0	Value = 0	Value = 2
7	Modbus® Address Bit 1	Value = 0	Value = 4
8	Modbus® Address Bit 2	Value = 0	Value = 8
4	No ECM	Open	
5		Open	
4	MDEC Comm.	Closed	
5	Isochronous	Open	
4	J1939 Communication	Open	
5		Closed	
4	MDEC Comm.	Closed	
5	Governor (VSG)	Closed	

Figure 1-9 DIP Switch Functions

Note: After setting DIP switches to the generator set application, be sure to *power down* and then *power up* the controller (disconnect the battery and then reconnect the battery of the generator set) or use the prime power switch, if equipped. The controller will NOT acknowledge the DIP switch change until after generator set controller is *powered up*.

Push down the end of the DIP switch near the OPEN label to open the switch, or push down the other end to close it. See Figure 1-10.



1. Push this side down to open circuit.

Figure 1-10 DIP Switch Open Position

Typically, the factory default settings have all the DIP switches in the closed position except the crank mode selection switch SW3 which is open for cyclic cranking. The overspeed selection switch SW1 is open on 50 Hz. units. Be sure to select the correct DIP switch configuration for each generator set application.

Overspeed Frequency (DIP Switch 1). The generator set overspeed frequency is set using DIP switch 1. Select 70 Hz for 60 Hz voltages and 60 Hz for 50 Hz voltages.

Temperature Cooldown (DIP Switch 2). The generator set will continue to run during a five-minute cooldown cycle or shut down immediately. The choice is made using DIP switch 2.

Engine Cranking (DIP Switch 3). The controller is factory-set for cyclic cranking. To change to the continuous cranking mode, use DIP switch 3.

Engine Configuration (DIP Switches 4 and 5). See Figure 1-9 for the DIP switch positions based on engine configurations regarding non-ECM, MDEC, and J1939 engine communication selections.

Modbus® Address (DIP Switches 6-8). Each Modbus® device requires a unique address. Address numbers are created using a binary number system with DIP switches 6-8. Figure 1-11 shows the DIP switch position for each address number.

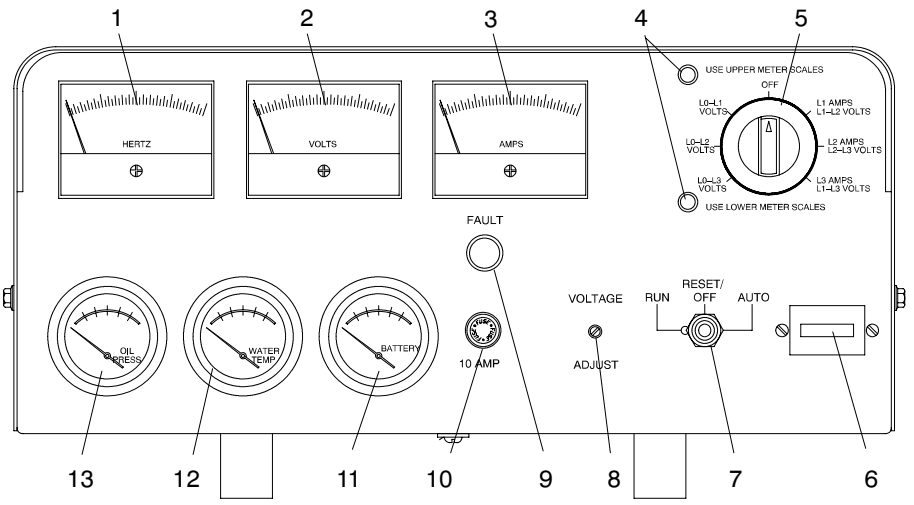
Modbus® Address	DIP Switches		
	6	7	8
	Value = 2	Value = 4	Value = 8
1	Open	Open	Open
3	Closed	Open	Open
5	Open	Closed	Open
7	Closed	Closed	Open
9	Open	Open	Closed
11	Closed	Open	Closed
13	Open	Closed	Closed
15	Closed	Closed	Closed

Figure 1-11 Modbus® Device Address

Modbus® is a registered trademark of Schneider Electric.

1.3 Expanded Decision-Maker 1 Controller

For identification of the expanded controller's indicators and controls and their functions, refer to Figure 1-12.



1. Frequency meter
2. AC voltmeter
3. AC ammeter
4. Scale lamps (upper/lower)
5. Selector switch
6. Hourmeter
7. Generator set master switch
8. Voltage adjustment control
9. Fault lamp
10. 10-amp controller fuse
11. DC voltmeter
12. Water temperature gauge
13. Oil pressure gauge

Figure 1-12 Expanded Decision-Maker™ 1 Controller

Figure 1-13 and Figure 1-14 describe the controls and indicators located on the controller.

Item	Description
AC ammeter	Meter displays the AC output amperage. Use the selector switch to choose the phase currents.
AC voltmeter	Meter displays the AC output voltage. Use the selector switch to choose the output lead circuits.
DC voltmeter	Meter displays the voltage of the starting battery(ies).
Fault lamp	Lamp illuminates during engine shutdown if the engine shuts down because of one of the following faults: high engine temperature, low water level, low oil pressure, overcrank, or overspeed. See Section 2.4.3, Fault Shutdowns, for additional shutdown information.
Frequency meter	Meter displays the frequency (Hz) of the generator set output.
Generator set master switch	Switch functions as the controller reset and generator set operation switch.

Figure 1-13 Controls and Indicators

Item	Description
Hourmeter	Hourmeter records the generator set total operating hours for reference in maintenance scheduling.
Oil pressure gauge	Gauge displays the engine oil pressure.
Scale lamps (upper/lower)	Lamps indicate which AC voltmeter and/or ammeter scales to read.
Selector switch	Switch selects the generator set output circuits to measure. When switched to a position with three circuit labels, the meters display the amperage on the lead shown in the upper label and the voltage between the two leads shown in the lower label. The AC ammeter and voltmeter function only with the switch in the ON position.
Voltage adjustment control	Control fine tunes (±5%) the generator set output voltage.
Water temperature gauge	Gauge displays the engine coolant temperature.
10-amp controller fuse	Fuse protects the controller circuitry from short circuits and overloads.

Figure 1-14 Controls and Indicators, continued

2.1 Prestart Checklist

To ensure continued satisfactory operation, perform the following checks or inspections before or at each startup, as designated, and at the intervals specified in the service schedule. In addition, some checks require verification after the unit starts.

Air Cleaner. Check for a clean and installed air cleaner element to prevent unfiltered air from entering the engine.

Battery. Check for tight battery connections. Consult the battery manufacturer's instructions regarding battery care and maintenance.

Coolant Level. Check the coolant level according to the cooling system maintenance information.

Note: Block heater damage. The block heater will fail if the energized heater element is not immersed in coolant. Fill the cooling system before turning on the block heater. Run the engine until it is warm, and refill the radiator to purge the air from the system before energizing the block heater.

Drive Belts. Check the belt condition and tension of the radiator fan, water pump, and battery charging alternator belt(s).

Exhaust System. Check for exhaust leaks and blockages. Check the silencer and piping condition and check for tight exhaust system connections.

Inspect the exhaust system components (exhaust manifold, exhaust line, flexible exhaust, clamps, silencer, and outlet pipe) for cracks, leaks, and corrosion.

- Check for corroded or broken metal parts and replace them as needed.
- Check for loose, corroded, or missing clamps and hangers. Tighten or replace the exhaust clamps and/or hangers as needed.
- Check that the exhaust outlet is unobstructed.
- Visually inspect for exhaust leaks *(blowby)*. Check for carbon or soot residue on exhaust components. Carbon and soot residue indicates an exhaust leak. Seal leaks as needed.

Fuel Level. Check the fuel level and fill the tank(s) regularly to ensure adequate fuel supply.

Ignition System. Ensure that the ends of all spark plug wires are properly seated onto the coil/distributor and the spark plug.

Lamp Test. Press the lamp test button, if equipped, to verify that all controller LEDs illuminate.

Oil Level. Maintain the oil level at or near, not over, the full mark on the dipstick. Keep the oil level in the mechanical governor, if equipped, at or near the full level.

Operating Area. Check for obstructions that could block the flow of cooling air. Keep the air intake area clean. Do not leave rags, tools, or debris on or near the generator set.

2.2 Generator Set Exercising

Operate the generator set under load once each week for one hour. Perform the exercise in the presence of an operator if the generator set does not have a programmed exercise mode or an automatic transfer switch with an exercise option.

During the exercise period apply a minimum of 35% load based on the nameplate standby rating, unless otherwise instructed in the engine operation manual.

The operator should perform all of the prestart checks before starting the exercise procedure. Start the generator set according to the starting procedure in the controller section of this manual. While the generator set is operating, listen for a smooth-running engine and visually inspect the generator set for fluid or exhaust leaks.

2.3 16-Light Controller Features

2.3.1 Normal Operation

Local Starting. Move the generator set master switch to the RUN position to start the generator set at the controller.

Note: The alarm horn sounds and the Not in Auto lamp lights when the generator set master switch is not in the AUTO position.

Note: The transient start/stop function of the 16-light controller prevents accidental cranking of the rotating engine. If the generator set master switch is momentarily placed in the OFF/RESET position and then is returned to the RUN position, the generator set slows to 750 rpm (25 Hz) and recranks before returning to rated speed.

Automatic Starting. Move the generator set master switch to the AUTO position to allow startup by an automatic transfer switch or a remote start/stop switch. Refer to the wiring diagrams for remote switch connection information.

The engine cranks up to 30 seconds continuously or 75 seconds cyclically (crank 15 seconds, rest 15 seconds, crank 15 seconds, etc.) before shutting down on an overcrank fault.

Note: The engine ECM may limit the crank cycle even if the controller is set to a longer time period.

Select the cyclic or continuous cranking mode on the controller circuit board. See Section 1.2.7 DIP switches.

Stopping. Run the generator set without load for 5 minutes to ensure adequate engine cooldown. To stop the generator set, place the generator set master switch in the OFF/RESET position and wait until the generator set stops completely.

Note: The generator set continues to run during a 5-minute cooldown cycle if a remote switch or automatic transfer switch signals the engine to stop.

Note: The controller circuit board DIP switches allow disabling the engine cooldown function.

2.3.2 Prime Power Mode Operation

The controller can operate in either the normal mode or the prime power mode. In prime power mode, the controller draws less current when the generator set master switch is in the OFF/RESET position, minimizing the battery drain. Use the prime power mode for installations that do not have a battery charger to help prevent discharging the battery when the generator set is not operating.

Moving the generator set master switch to the OFF/RESET position disables all controller functions. Moving the generator set master switch to the AUTO position restores controller functions.

Enabling and Disabling the Prime Power Mode. To enable the prime power mode, use jumpers to connect TB2-1P to TB2-2P, TB2-3P to TB2-4P, and TB2-3 to TB2-4. To deactivate the prime power mode, remove these jumpers. See Figure 1-7, Figure 1-8, and Figure 2-1.

Terminal	Purpose
1P	Prime power operation.
2P	Prime power operation.
3	Remote start ground. Connect transfer switch or remote start switch to TB2-3 and TB2-4.
3P	Prime power operation.
4	Remote start. Connect transfer switch or remote start switch to TB2-3 and TB2-4.
4P	Prime power operation.

Figure 2-1 16-Light Controller TB2 Terminal Strip

Prime Power Starting. The prime power mode provides local starting only at the controller. The AUTO position no longer functions as a remote start. When the generator set master switch is in the OFF/RESET position, the controller functions are inoperative. Move the generator set master switch to the AUTO position to start the generator set. Do not start the generator set with the master switch in the RUN position because the alarm horn will sound.

Note: Move the generator set master switch to the AUTO position to return controller functions to normal.

Prime Power Stopping. Move the generator set master switch to the OFF/RESET position to stop the generator set and power down the controller.

Note: The controller functions are inoperative when the generator set master switch is in the OFF/RESET position.

2.3.3 Emergency Stopping

Activate the controller emergency stop switch, if equipped, or the optional remote emergency stop switch for immediate shutdown.

Use the emergency stop switch(es) for emergency shutdowns only. Use the generator set master switch for normal shutdowns.

The unit shuts down and the controller emergency stop lamp lights if an operator activates either the local or remote emergency stop switch.

Use the following procedure to restart the generator set after shutdown by an emergency stop switch. Refer to Section 2.3.5, Controller Resetting After a Fault Shutdown, to restart the generator set following a fault shutdown.

Emergency Stop Switch Resetting Procedure

1. Investigate the cause of the emergency stop and correct the circuit or wiring problem(s).

2. If the remote emergency stop switch was activated, reset the switch by replacing the glass piece. If the controller-mounted emergency stop switch (if equipped) was activated, reset the controller emergency stop switch by rotating the switch clockwise until it springs back to its original position.

   Note: The controller auxiliary fault lamp lights if the generator set master switch is in the RUN or AUTO position during the resetting procedure.

3. Toggle the generator set master switch to the OFF/RESET position and then to the RUN or AUTO position to restart the generator set. The generator set does not crank until the resetting procedure is completed.

2.3.4 Fault Shutdowns

The generator set shuts down automatically under the fault conditions listed in Figure 2-2.

Fault	Description
High engine temperature	The high engine temperature shutdown shuts down the unit 5 seconds after a fault. The shutdown does not function during the first 30 seconds following startup. **Note:** The high temperature shutdown functions only when the coolant level is in the operating range.
Low coolant level, if equipped	The low coolant level shutdown shuts down the unit 5 seconds after the fault. The shutdown does not function during the first 30 seconds following startup.
Low oil pressure	The low oil pressure shutdown shuts down the unit 5 seconds after fault detection. The shutdown does not function during the first 30 seconds following startup. **Note:** The low oil pressure shutdown does not protect against low oil level. Check the oil level at the engine.
Overcrank	Overcrank shuts down the unit after 45 seconds of continuous cranking. Shutdown occurs after 75 seconds of cyclic cranking (crank 15 seconds, reset 15 seconds, crank 15 seconds, etc., for a total of 75 seconds). Shutdown occurs after 15 seconds if the engine or starter does not turn (locked rotor). **Note:** The controller has an automatic restart function. The generator set attempts to restart if the engine speed drops below 390 rpm (output frequency of 13 Hz). Continued low engine speed causes an overcrank fault condition.
Overspeed	Overspeed shuts down the unit immediately when governed frequency on 50/60 Hz models exceeds 60/70 Hz. **Note:** The controller circuit board DIP switches allow 50 Hz (60 Hz shutdown) or 60 Hz (70 Hz shutdown) selection.
Overvoltage,if equipped	Overvoltage shuts down the unit and lights the auxiliary lamp when voltage is at least 15% over the nominal voltage for longer than 2 seconds. **Note:** Overvoltage can damage sensitive equipment in less than 1 second. Provide separate overvoltage protection for online equipment requiring faster shutdowns.

Figure 2-2 Fault Shutdowns

2.3.5 Controller Resetting After a Fault Shutdown

Use the following procedure to restart the generator set after a fault shutdown. Refer to Section 2.3.3, Emergency Stopping, to reset the generator set after an emergency stop.

1. Move the controller alarm horn switch to the SILENCE position. If equipped, the audiovisual annunciator alarm horn and lamp are activated. Move the audiovisual annunciator alarm switch to SILENCE to stop the alarm horn. The audiovisual annunciator lamp stays lit.

2. Disconnect the generator set from the load by using the line circuit breaker or the automatic transfer switch.

3. Correct the cause of fault shutdown. See the Safety Precautions section of this manual before proceeding.

4. Start the generator set by moving the generator set master switch to the OFF/RESET position and then to the RUN position. If equipped, the audiovisual annunciator alarm horn sounds and lamp goes out.

5. Verify that the cause of the shutdown was corrected by test operating the generator set.

6. Reconnect the generator set to the load by using the line circuit breaker or the automatic transfer switch.

   Note: Place the generator set master switch in the AUTO position before silencing the alarm horn.

7. Move the generator set master switch to the AUTO position for startup by remote transfer switch or remote start/stop switch. If equipped, move the audiovisual annunciator alarm switch to NORMAL.

8. Move the controller alarm horn switch to the NORMAL position.

2.4 Expanded Decision-Maker 1 Controller

2.4.1 Generator Set Starting

Local Starting. Move the generator set to the RUN position to immediately start the generator set.

Automatic Starting. Move the generator set master switch to the AUTO position to allow startup by the automatic transfer switch or the remote start/stop switch connected to controller terminals TB1-3 and TB1-4.

Note: The controller allows up to 30 seconds of continuous cranking before overcrank shutdown occurs.

Note: The engine ECM may limit the crank cycle even if the controller is set to a longer time period.

2.4.2 Generator Set Stopping

Local Stopping

1. Run the generator set at no load for 5 minutes to ensure adequate engine cooldown.

2. Move the generator set master switch to the OFF/RESET position. The engine stops.

Automatic Stopping

1. The automatic transfer switch (ATS) or other device disconnects the load from the generator set.

2. The generator set continues to run for a preset time if the ATS is equipped with an engine cooldown time delay.

3. The ATS opens the connection between controller terminals TB1-3 and TB1-4. The generator set shuts down if the generator set master switch is in the AUTO position.

2.4.3 Fault Shutdowns

The generator set shuts down automatically under the fault conditions shown in Figure 2-3 and cannot be restarted until the fault condition is corrected. Reset the controller after a fault shutdown.

The fault lamp does not stay lit after the generator set shuts down on a fault condition.

2.4.4 Controller Resetting After a Fault Shutdown

Use the following procedure to restart the generator set after a fault shutdown.

1. Disconnect the generator set from the load using the line circuit breaker or automatic transfer switch. See the Safety Precautions at the beginning of this section before proceeding.

2. Correct the cause of the fault shutdown. See the Safety Precautions at the beginning of this section before proceeding.

3. Start the generator set by moving the generator set master switch to RESET/OFF and then to RUN.

4. Verify that the cause of the shutdown has been corrected by test operating the generator set.

5. Reconnect the generator set to the load using the line circuit breaker or automatic transfer switch.

6. Move the generator set master switch to the AUTO position for startup by remote transfer switch or remote start/stop switch.

Fault	Description
High engine temperature	Shutdown occurs 5 seconds after the fault. The high engine temperature shutdown does not function during the first 5 seconds after startup. **Note:** The high temperature shutdown functions only when the coolant level is in the operating range.
Low coolant level	Shutdown occurs 5 seconds after the fault. The low coolant level shutdown does not function during the first 5 seconds after startup.
Low oil pressure	Shutdown occurs 5 seconds after the fault. The low oil pressure shutdown does not function during the first 5 seconds after startup. **Note:** The low oil pressure shutdown does not protect against low oil level. Check the oil level at the engine.
Overcrank	Shutdown occurs after 30 seconds of continuous cranking. Shutdown occurs 30 seconds after startup if there is no AC output.
Overspeed	Shutdown occurs immediately when the governed frequency on the 50 and 60 Hz models exceeds 70 Hz.

Figure 2-3 Fault Shutdowns

Under normal operating conditions, the generator set's alternator requires no normal service. Consult the prestart checklist in Section 2.1 for a list of routine checks.

3.1 Alternator Service

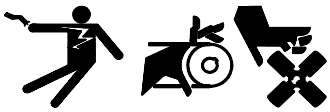
When operating the generator set under dusty or dirty conditions, use dry compressed air to blow dust out of the alternator while the generator set is running. Direct the stream of air through openings in the generator set end bracket.

3.2 Engine Service

Perform engine service at the intervals specified in the engine manufacturer's service literature. Contact an authorized service distributor/dealer to obtain service literature.

Note: Have maintenance work, including battery service, performed by appropriately skilled and suitably trained maintenance personnel familiar with generator set operation and service.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

⚠ WARNING

Hot engine and exhaust system.
Can cause severe injury or death.

Do not work on the generator set until it cools.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

⚠ WARNING

Hazardous voltage. Moving parts.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Servicing the generator set when it is operating. Exposed moving parts can cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

3.3 Service Schedule

System—Component	Action					Interval
	Visually Inspect	Check	Change	Clean	Test	
Fuel						
Day tank level	X	X				Weekly
Flexible lines and connections	X		R			Weekly
Fuel level switch	X				X	Weekly
Main tank supply level		X				Weekly
Solenoid valve operation	X				X	Weekly
Transfer pump operation	X				X	Weekly
Water in system, remove		●		●		Weekly
Filter(s)			●			Quarterly
Gasoline supply			R			Six Months
Fuel piping	X					Yearly
Tank vents and return lines for obstructions		X				Yearly
Lubrication						
Oil level	●	●				Weekly
Crankcase breather	●		●			Quarterly
Change oil			●			First 50 Hours, Then Every 250 Hours
Replace filter(s)*			●			
Cooling						
Radiator fan bolt torque (1500–2800REOZDC with unit-mounted radiator)		X				Initially 8 Hours, Then Every 100 Hours
Air cleaner to room/enclosure		X				Weekly
Block heater operation		X				Weekly
Coolant level	●	●				Weekly
Flexible hoses and connectors	X	X				Weekly
Water pump(s)	●					Weekly
Fan and alternator belts	●	●	R			Monthly
Coolant temperature protection level					●	Six Months
Lubricate fan bearings (1200–2000 kW)	X	X				200 Hours or Six Months
Air ducts, louvers		X		X		Yearly
Coolant			●			Yearly
Heat exchanger				X		Yearly
Louver motors and controls	X			X	X	Yearly
Radiator exterior				X		Yearly
Water supply to heat exchanger		X				Yearly
Exhaust Line						
Drain condensate trap		X				Weekly
Leakage	X	X				Weekly
Insulation, fire hazards	X					Quarterly
Flexible connector(s)	X					Six Months
Excessive back pressure					X	Yearly
Hangers and supports	X					Yearly
DC Electrical System						
Battery charger operation, charge rate	X					Monthly
Battery electrolyte level		X				Monthly
Battery specific gravity, charge state					X	Monthly
Recharge after engine start		X				Monthly
Remove corrosion, clean and dry battery and rack	X			X		Monthly
Clean and tighten battery terminals	X	X				Quarterly
Tighten DC electrical connections		X				Six Months

● Follow procedures and frequencies indicated in the engine manufacturer's maintenance manual. If not indicated, follow this service schedule. Some items may not apply to all generator sets.
R Replace as necessary.
X Action
* Service more frequently if operated in dusty areas.

Service Schedule, continued

System—Component	Action					Interval
	Visually Inspect	Check	Change	Clean	Test	
AC Electrical System						
Controller lamp test	X				R	Weekly
General Inspection	X					Weekly
Circuit breakers, fuses†	X	X	R	X	X	Monthly
Wire abrasions where subject to motion	X	X				Quarterly
Safety and alarm operation		X			X	Six Months
Tighten control and power wiring connections		X				Yearly
Transfer switch main contacts†	X			X		Yearly
Voltage-sensing device/relay adjustment†		●			●	Yearly
Wire-cable insulation breakdown	X				X	3 Years or 500 Hours
Engine and Mounting						
General inspection	●					Weekly
Governor operation, lubricate moving parts	●	●				Monthly
Air cleaner service		●	●			Six Months
Choke, carburetor adjustment		●				Six Months
Governor oil (mechanical governor only)		●				Yearly
Ignition components	●			●		Yearly
Injector pump and injector flow rate, pressure, spray pattern		●			●	Yearly
Valve clearance		●				3 Years or 500 Hours
Bolt torque		●			●	3 Years or 500 Hours
Remote Control System, etc.						
Compartment condition	X			X		Weekly
Remote control					X	Monthly
Run generator set					X	Monthly
Alternator						
General inspection	X					Weekly
Rotor and stator	X			X		Yearly
Bearing condition	X	X	R			Yearly
Exciter	X	X		X		Yearly
Voltage regulator	X	X		X		Yearly
Measure and record resistance readings of windings with insulation tester (Megger®, with SCR assembly or rectifier disconnected)					X	Yearly
Blow dust out of alternator*	X			●		2 Years or 300 Hours
General Condition of Equipment						
Any condition of vibration, leakage, noise, temperature, or deterioration	X	X		X		Weekly
Ensure that system is set for automatic operation	X					Weekly
Interior of equipment room or outdoor weather housing	X			X		Weekly

● Follow procedures and frequencies indicated in the engine manufacturer's maintenance manual. If not indicated, follow this service schedule. Some items may not apply to all generator sets.
R Replace as necessary.
X Action.
* Service more frequently if operated in dusty areas.
† Do not break manufacturer's seals or internally inspect these devices.

Megger® is a registered trademark of Biddle Instruments.

3.4 Alternator Bearing Service

Have an authorized service distributor/dealer perform service.

3.4.1 20–300 kW Models

Replace the end bracket bearing every 10,000 hours of operation in standby and prime power applications. Service the bearing more frequently if the annual inspection indicates excessive rotor end play or bearing damage. Replace the tolerance ring, if equipped, following end bracket removal. The sealed end bracket bearing requires no additional lubrication.

3.4.2 350–2000 kW Models with Single-Bearing Alternator

The alternator bearing requires lubrication at intervals specified in the generator set technical manual. Use Chevron SRI or equivalent antifriction, high-quality grease with a lubrication temperature range of –30° to +175°C (–22° to +350°F).

3.4.3 1250–2000 kW Model with Two-Bearing Alternator

Refer to the generator set service manual for bearing maintenance information.

3.5 Diesel Fuel Systems

3.5.1 Bleeding Air from Fuel System

Bleed air from the fuel system after fuel system maintenance, such as replacing the fuel filter(s) using the hand prime pump kit, when equipped. The hand prime fuel pump eliminates the need for cranking the engine to bleed air from the fuel system.

Note: Bleed air from the fuel system according to the engine manufacturer's instructions. Trapped air in the fuel system causes difficult starting and/or erratic engine operation.

Note: Correct any fuel leaks encountered during the priming procedure.

1. Place the fuel valves in the fuel system prime position. Close the fuel valve located between the pipe tee and the engine. Open the fuel valves on each side of the fuel prime pump. See Figure 3-1.

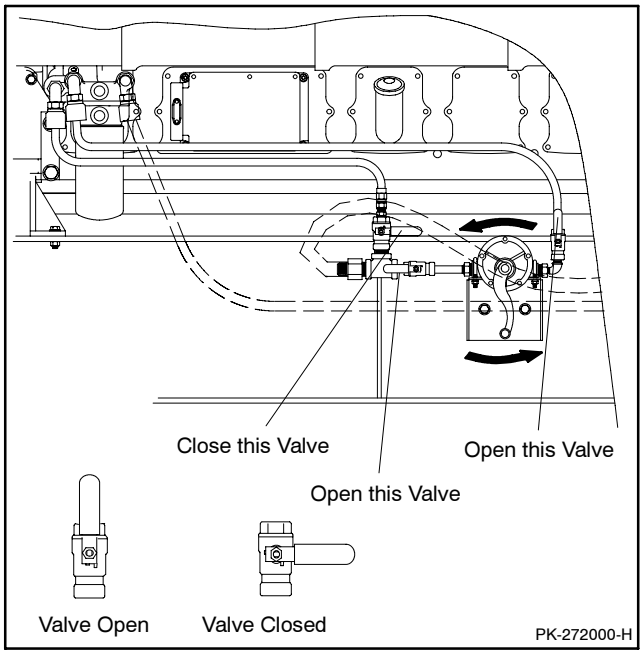


Figure 3-1 Hand Prime Pump with Valve Positions for Fuel Priming (Generator Set Without a Fuel/Water Separator Shown)

Note: The illustration shows a generator set without a fuel/water separator. The valve location and position for a generator set equipped with a fuel/water separator is similar.

2. Loosen the bleed screw at the engine. Refer to the engine operation manual for location of the bleed screw(s). The bleed screw allows air to be expelled from the fuel system when the hand prime pump is operated.

3. Rotate hand prime pump handle counterclockwise until fuel flows from the bleed screw. Stop pumping.

4. Tighten the bleed screw. Wipe up any fuel leakage.

5. Place the fuel valves in the normal operation position. Open the fuel valve located between the pipe tee and the engine. Close the fuel valves on each side of the fuel prime pump.

3.5.2 Subbase Inner Fuel Tank Alarm

This kit provides for both audible and visual alarm from a location remote from the generator set if a leak is detected in the inner fuel tank of the double-wall subbase fuel tanks. See Figure 3-2. If the inner tank is leaking, a sensor installed in the outer tank sends an electrical signal to the alarm plate when the sensor becomes immersed in the fuel collecting in the outer tank. If a leak is detected, the alarm horn will sound and the fault lamp will light. The alarm horn is quieted by moving the alarm switch to the SILENCE position; the alarm lamp remains lit until the fault is corrected. See Figure 3-3 for troubleshooting information.

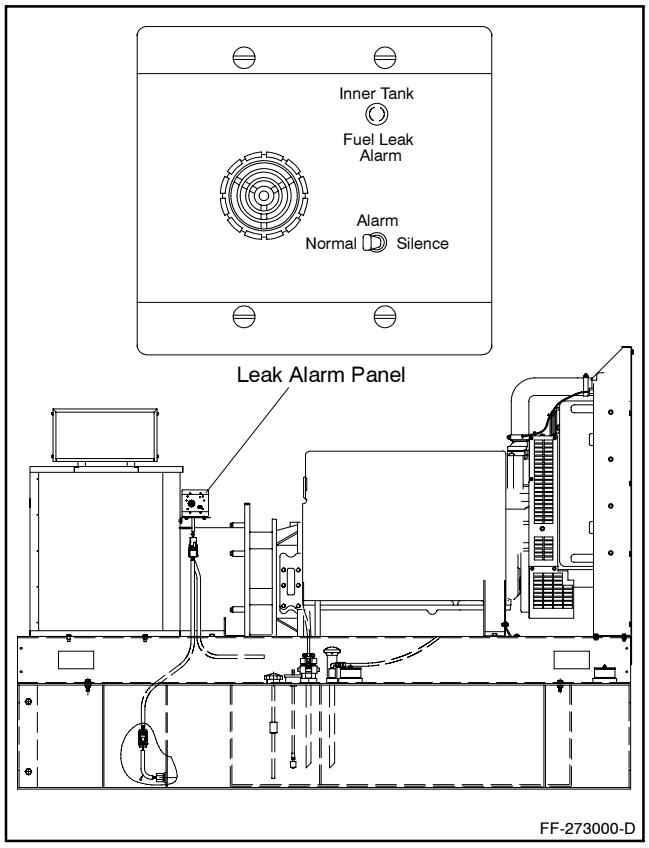


Figure 3-2 Inner Fuel Tank Leak Alarm (20–300 kW Model Shown)

Alarm Switch Position	Float Switch Position	Observation
Normal	Open	The alarm horn and the lamp are not energized.
Normal	Closed	The alarm horn and lamp activate when a fuel leak occurs. If the alarm switch is moved to the silence position the lamp stays on until the fuel leak fault is corrected.
Silence	Open	The alarm horn sounds to alert the user that the alarm horn switch is not in the normal position and that the alarm horn will not sound should a fuel leak occur.

Figure 3-3 Inner Fuel Tank Leak Alarm Troubleshooting

Resetting Procedure

Use the following procedure to reset the alarm after a fault alarm.

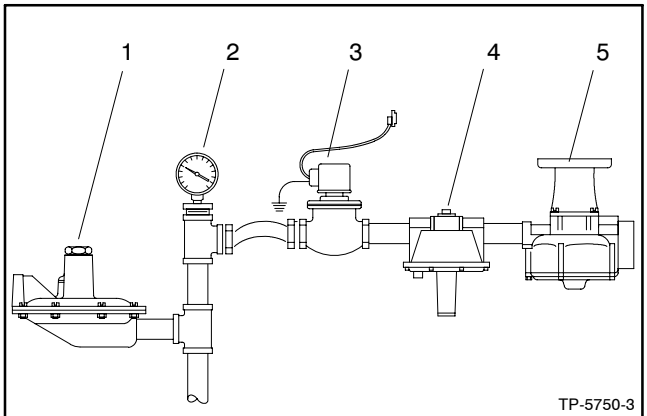
1. Move alarm switch to the SILENCE position to stop alarm horn. Lamp will remain lit.
2. Disconnect generator set from load with line circuit breaker or automatic transfer switch.
3. Repair or replace the inner fuel tank.
4. Move generator set master switch to the OFF/ RESET position and then to the RUN position for startup. Alarm horn sounds and lamp goes out.
5. Reconnect generator set to load via line circuit breaker or automatic transfer switch.
6. Move generator set master switch to the AUTO position for startup by remote transfer switch or remote start/stop switch. Move alarm switch to the NORMAL position.

3.6 Gas/Gasoline Fuel Systems

This section describes fuel systems that are not covered in the engine operation manual or engine service manual.

3.6.1 Gaseous Fuel System Concept

The gaseous fuel system uses a fuel valve with a solenoid to control the fuel flow to the fuel regulator. The generator set-mounted regulator reduces the fuel pressure as fuel passes to the carburetor. See Figure 3-4.



1. Primary regulator (supplied by gas supplier or customer)
2. Pressure gauge
3. Solenoid valve
4. Secondary regulator
5. Carburetor

Figure 3-4 Fuel Regulator and Valve, Typical

The carburetor/mixer controls the ratio of fuel to air under varying load and speed conditions. Because the carburetor receives fuel in a gaseous state, it does not have to vaporize the fuel. When switching from natural gas to LP gas or LP gas to natural gas, verify that the electronic governor maintains the rated engine speed (1800 rpm at 60 Hz or 1500 rpm at 50 Hz). If the engine speed is incorrect, refer to the generator set service manual for the governor adjustment procedure.

3.6.2 LP Liquid Withdrawal Fuel System Concept

With the LP liquid withdrawal fuel system, pressurized liquid LP fuel passes from the tank to a vaporizer. The vaporizer converts the liquid fuel to gas before sending it to the carburetor. The system also includes a fuel valve that shuts off the fuel flow when the engine stops. Contact an authorized service distributor/dealer for availability.

3.6.3 LP Gas/Natural Gas Conversion for Straight Gas Fuel System

Most models operate on either LP gas or natural gas fuel by performing the fuel conversion procedure. Some models require a different fuel kit when changing gas fuels. Consult your local generator set distributor/dealer for additional information.

Fuel conversion may decrease generator set output and affect exhaust emissions. Consult your local generator set distributor/dealer for additional information.

Fuel Conversion Procedure

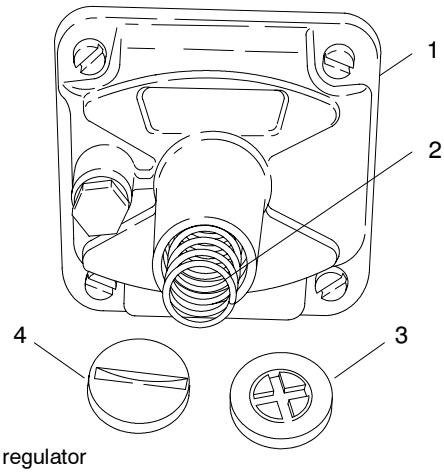
When converting the generator set to operate with LP gas, remove the internal spring from the secondary regulator. Install the spring to operate the generator set on natural gas.

Note: Not all fuel regulators require spring and retainer removal for fuel conversion. A hang tag on the fuel regulator identifies the conversion procedure.

LP Fuel Conversion Procedure

Use the following steps to remove the internal spring from the fuel regulator:

1. Remove the fuel regulator cover plug. See Figure 3-5.



1. Fuel regulator
2. Spring
3. Adjustment screw
4. Cover plug

Figure 3-5 Fuel Regulator, Typical

2. Remove the adjustment screw and spring from the fuel regulator. Save the adjustment screw and spring for possible conversion back to natural gas.

3. Reinstall the cover plug.

Natural Gas Fuel Conversion Procedure

Use the following steps to convert the generator set to natural gas:

1. Remove the fuel regulator cover plug. See Figure 3-5.

2. Replace the spring and adjustment screw.

3. Connect a manometer to check the fuel supply pressure on the carburetor side of the regulator downstream of any fuel system equipment accessories. The recommended fuel supply pressures are shown on the generator set spec sheet.

4. Adjust the fuel supply pressure with the generator set running at full load. Rotate the adjustment screw on the fuel regulator until the pressure indicated by the manometer matches the specified pressure. Use the lower pressure value if the generator set still provides good response and full power. Lower-than-specified pressures may result in poor response to load changes or lack of power.

5. Reinstall the cover plug.

3.6.4 Fuel System Changeover Kits

Automatic Changeover

A changeover fuel system kit provides automatic changeover from natural gas to LP gas vapor or from LP gas vapor to natural gas. The primary and backup fuels each have a secondary fuel regulator and a fuel valve. Typically, the primary fuel is natural gas; the backup fuel is LP gas vapor. When the generator set starts, the primary fuel valve opens and the backup fuel valve closes. The primary fuel line has a vacuum switch in series with a relay connected to the start/run circuit. When the primary fuel pressure drops below 0.6 kPa (1.4 oz./in.^{2}) or 6.4 cm (2.5 in.) water column , a relay opens the backup fuel valve and closes the primary fuel valve. When the primary fuel pressure rises above 0.6 kPa (1.4 oz./in.^{2}) or 6.4 cm (2.5 in.) water column, the generator set uses the primary fuel. Contact an authorized service distributor/dealer for kit availability.

Manual Changeover

A manual changeover fuel system allows manual changeover from gasoline to natural gas or LP gas, or from natural gas or LP gas to gasoline. Typically, the combination system uses gas as the primary, preferred fuel and gasoline in emergencies. If the primary fuel is unavailable (an empty fuel tank or fuel supply disruption), the system uses gasoline. A toggle switch on the generator set controls the fuel choice and energizes either a fuel solenoid and electric fuel pump for gasoline or a fuel valve for gas. Pull out the control cable for gasoline and push in the control cable for gas.

3.6.5 Carburetor Adjustment

Before adjusting the carburetor, verify that the engine compression and ignition system meet specifications. Do not adjust the carburetor to compensate for other engine disorders. If the engine speed is incorrect, adjust the electronic governor to achieve 1800 rpm (at 60 Hz) or 1500 rpm (at 50 Hz). Adjust the carburetor if governor adjustment alone does not result in the desired engine speed.

Adjusting the carburetor affects the engine fuel mixture. Routine carburetor adjustment is not necessary. However, if the carburetor is removed or tampered with, the carburetor may require adjustment to achieve optimum engine performance. Some engines have sealed carburetors that are not adjustable.

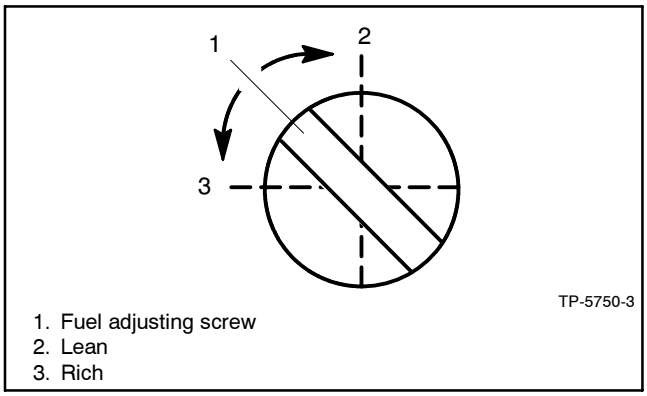
Gasoline Carburetor Adjustment

Refer to the engine operation manual or engine service manual for gasoline carburetor adjustment information.

Gaseous Carburetor (Fuel Mixer) Adjustment Procedure

Use the following procedure to adjust the carburetor (fuel mixer).

1. Start the generator set and run it at approximately half load.
2. Adjust the engine fuel mixture screw (Figure 3-6) until the engine runs smoothly.
3. Apply varying loads and readjust the carburetor as necessary to achieve smooth engine performance at all load levels.
4. Stop the generator set.



1. Fuel adjusting screw
2. Lean
3. Rich

Figure 3-6 Fuel Mixture Adjustment, Typical

3.6.6 Fuel System Maintenance

Gasoline Models

Clean or replace the fuel filter at the specified interval. Service the filters more frequently if the engine runs roughly, as a clogged fuel filter can cause rough engine operation. Some models use a disposable inline fuel filter, which must be replaced. Other models have a fuel pump with an integral fuel filter that requires cleaning at the specified interval.

Gaseous Models

This fuel system requires no regular maintenance.

3.7 Cooling System

The cooling system maintenance information applies to radiator-cooled models and city-water-cooled (heat exchanger) models. The cooling systems function similarly even though they use different components. Radiator-cooled models have a radiator with a pressure cap and coolant recovery tank. City-water-cooled models have a heat exchanger and an expansion/surge tank with a pressure cap.

⚠ WARNING

Hot coolant and steam.
Can cause severe injury or death.

Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.

Allow the engine to cool. Release pressure from the cooling system before removing the pressure cap. To release pressure, cover the pressure cap with a thick cloth and then slowly turn the cap counterclockwise to the first stop. Remove the cap after pressure has been completely released and the engine has cooled. Check the coolant level at the tank if the generator set has a coolant recovery tank.

Note: Engine damage. Bleed the air from the cooling system to prevent overheating and subsequent engine damage.

Note: Block heater damage. The block heater will fail if the energized heater element is not immersed in coolant. Fill the cooling system before turning on the block heater. Run the engine until it is warm, and refill the radiator to purge the air from the system before energizing the block heater.

3.7.1 Coolant Level Check

Check the coolant level in the coolant recovery tank, if equipped. Maintain the coolant level between the high and low marks.

Note: Periodically check the coolant level by removing the pressure cap. Do not rely solely on the level in the coolant recovery tank. Add fresh coolant until the level is just below the overflow tube opening of the filler neck.

3.7.2 Cooling System Component Inspection

To prevent generator set shutdown or damage caused by overheating:

- Keep the cooling air inlets clean and unobstructed.
- Inspect the radiator's exterior for obstructions. Remove dirt and foreign material using a soft brush or cloth to avoid damaging the radiator fins.
- Check the hoses and connections for leaks. Replace any cracked, frayed, or spongy hoses.
- Check the condition and tension of the radiator fan and water pump belt(s). Follow the belt tension procedure in this manual and/or the engine operation manual.
- Check the pressure cap seal and replace a cracked or deteriorated cap. Remove dirt and other debris from the pressure cap and filler neck. The pressure cap raises the boiling point of the coolant, enabling higher operating temperatures. Replace a leaking pressure cap with one rated for the same pressure. The pressure cap rating usually appears on the pressure cap.

3.7.3 Cooling System Drainage Procedure

For optimum protection, drain, flush, and refill the cooling system at the intervals listed in the service schedule.

Note: Dispose of all waste materials (oil, fuel, coolant, filters, and gaskets) in an environmentally safe manner.

1. Deenergize the block heater, if equipped.
2. Remove the pressure cap to allow the entire system to drain and prevent air pockets from restricting coolant flow through the engine block.
3. Open the radiator and/or engine block coolant drain valve(s) and allow the system to drain.
4. If the inside of the radiator has mineral deposits or the used coolant contains dirt or grease, refer to Section 3.7.4, Cooling System Flush and Clean Procedure. If the cooling system does not have mineral deposits, go to Section 3.7.5, Cooling System Refilling Procedure.

3.7.4 Cooling System Flush and Clean Procedure

Use the instructions in the engine operation manual when available to flush and clean the cooling system. Otherwise, use the following procedure and the cooling system cleaner manufacturer's instructions.

1. Flush the cooling system with clean water.
2. If the inside of the radiator still has mineral deposits, use a radiator cleaner to remove the remaining deposits following the manufacturer's instructions.
3. Drain, clean, and flush the coolant recovery tank.

3.7.5 Cooling System Refilling Procedure

See the generator set spec sheet for coolant capacity.

Note: Do not add coolant to a hot engine. Adding coolant to a hot engine can cause the cylinder block or cylinder head to crack. Wait until the engine has cooled.

1. Remove the pressure cap.
2. Close radiator and/or engine block coolant drain valve(s) and tighten cooling system hose clamps.
3. Open the air-bleed petcocks, if equipped. Close the air-bleed petcocks when coolant begins to flow from them.
4. Add coolant additives or water pump lubricants according to the engine manufacturer's recommendations in the engine operation manual.
5. Fill the cooling system with the recommended coolant/antifreeze mixture of 50% ethylene glycol and 50% clean, softened water to inhibit rust/corrosion and prevent freezing.

   Note: A coolant solution of 50% ethylene glycol provides freezing protection to -37°C (-34°F) and overheating protection to 129°C (265°F). A coolant solution containing less than 50% ethylene glycol may not provide adequate freezing and overheating protection. A coolant solution containing more than 50% ethylene glycol can cause engine or component damage. Do not use alcohol or methanol antifreeze or mix them with the specified coolant. Refer to the engine operation manual for recommendations regarding the coolant mixture to use in extreme temperatures.

6. Replace the pressure cap.
7. Fill the coolant recovery tank to the low mark.
8. Operate the generator set until the thermostat opens when the upper cooling system hose warms.
9. Stop the engine and allow it to cool.
10. Remove the pressure cap.
11. Add coolant to bring the coolant level to just below the overflow tube opening of the filler neck.
12. Replace the pressure cap.
13. Maintain the coolant level in the coolant recovery tank between the high and low marks.

    Note: Air pockets often form in the engine water jacket when the coolant system is refilled. Check the coolant level in the coolant recovery tank after each generator set operation and add coolant as necessary until the coolant level stabilizes. Then check the coolant at the interval specified in the service schedule.

14. Reenergize the block heater, if equipped.

3.8 Radiator Fan Bolt Retorque

Adapted from Service Bulletin SB-683 12/07a.

The radiator fan bolts must be initially checked after approximately 8 hours of operation and then rechecked after each 100 hours of operation. This scheduled service is required on all 1500-2800REOZDC unit-mounted radiator models using a 2743 mm (108 in.) diameter fan.

Perform the scheduled service steps in the order shown.

Required Tools

- Socket wrench sets American Standard and Metric sizes
- Torque wrench, up to 203 Nm (150 ft. lb.)

Procedure

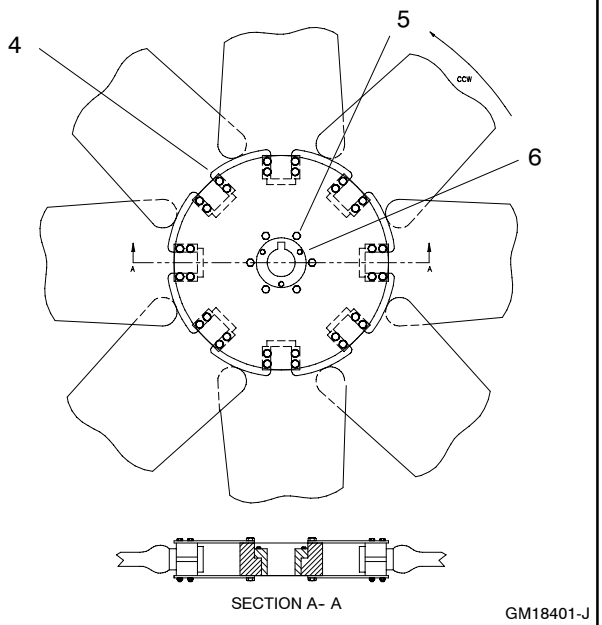
1. Place the generator set master switch in the OFF/RESET position.
2. Disconnect the power to the battery charger, if equipped.

3. Disconnect the generator set engine starting battery(ies), negative (-) lead first.

4. Remove the fan guards, screens, and covers as necessary to access the radiator fan hardware.

5. Inspect the blades for cracks or other damage. Verify that all hardware is present. Replace as needed.

6. Retorque the (32 qty.) blade retention bolts/nuts to 136 Nm (100 ft. lb.). See Figure 3-7.



4. (32) blade retention bolts/nuts, 136 Nm (100 ft. lb.)
5. (12) hub boss cap screws, 102 Nm (75 ft. lb.)
6. (3) bushing cap screws, 43 Nm (32 ft. lb.)

Figure 3-7 Fan Hardware Location and Torque

7. Retorque the (12 qty.) hub boss cap screws to 102 Nm (75 ft. lb.). There are six screws on each side of the fan.

8. Retorque the (3 qty.) bushing cap screws to 43 Nm (32 ft. lb.).

9. Replace the fan guards, screens, and covers that were removed to access the radiator fan hardware.

10. Check that the generator set master switch is in the OFF position.

11. Reconnect the generator set engine starting battery, negative (-) lead last.

12. Reconnect power to the battery charger, if equipped.

13. Place the generator set master switch to the RUN position to start the generator set. Refer to the respective generator set operation manual as needed.

14. Listen and observe the fan operation.

15. **Immediately shut down the generator set if abnormal noise or fan assembly vibration is observed.** Correct the problem and go back to step 13.

16. After several minutes of generator set operation without abnormal noise or vibration, shut down the generator set by placing the generator set master switch to the OFF/RESET position.

3.9 Radiator Fan Bearing Lubrication

The following procedure applies only to 1200–2000 kW generator sets. Lubricate the radiator fan shaft and idler shaft bearings at every engine oil change to avoid bearing damage. Lubricate the bearings every 200 hours of operation when the generator set runs in ambient temperatures below 29°C (85°F) or when the generator set runs in a dusty and/or humid environment.

Lubrication and Drive Belt Adjustment Procedure

Lubricate the fan shaft and idler shaft bearings with a lithium-complex base, multi-purpose grease with antirust, antifoam, and extreme-pressure additives having a minimum dropping point of 204°C (400°F). Use Mobil Mobilith AW2 NLGI Grade 2 or equivalent.

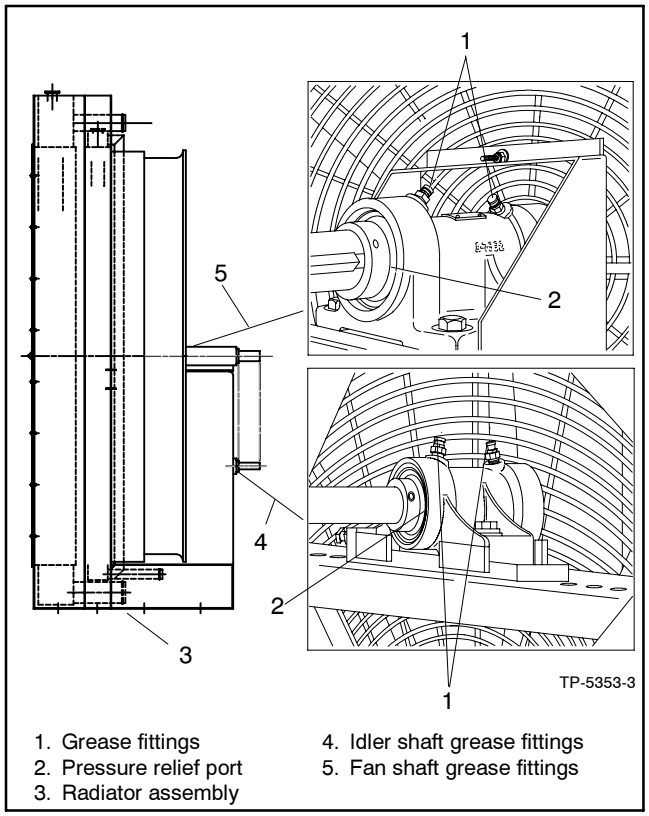
1. Place the generator set master switch in the OFF/RESET position.

2. Disconnect the generator set engine starting battery(ies), negative (-) lead first, and disconnect power to the battery charger.

3. Remove the belt guards to expose the fan shaft and idler shaft bearings.

4. Inject grease into the two bearings on the fan shaft block and the two bearings on the idler shaft block using a grease gun until a 3–6 mm (0.13–0.25 in.) grease column shows at the bearing pressure relief port. See Figure 3-8.

   Note: The fan shaft and idler shaft bearings have pressure relief ports to prevent bearing damage caused by overlubrication.



1. Grease fittings
2. Pressure relief port
3. Radiator assembly
4. Idler shaft grease fittings
5. Fan shaft grease fittings

Figure 3-8 Radiator Fan Bearings and Pressure Relief Ports, Typical

5. Remove excess grease from the bearing pressure relief ports.

6. Inspect the fan drive belt and replace if it is damaged or worn. Check the fan belt tension using a poly V-belt tension gauge and adjust the tension, if necessary. See Figure 3-9.

Generator Set Model	New Belt, N (lbf.)	Used Belt,* N (lbf.)
1200-2000 kW	2450-2890 (550-650)	1650-1910 (370-430)
* A belt is considered used after 50 hours of service.		

Figure 3-9 Poly V-Belt Tension Specifications

7. Reinstall the belt guards using the original hardware.

8. Reconnect the generator set engine starting battery(ies), negative (-) lead last.

9. Test run the generator set for a few minutes and listen for belt noise (squeal) indicating a slipping belt. Stop the generator set.

If the belt slips after the belt tension procedure, clean the pulley surfaces and repeat the belt tension procedure. If slippage continues, replace the fan belt.

3.10 Battery

⚠ WARNING

Sulfuric acid in batteries.
Can cause severe injury or death.

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

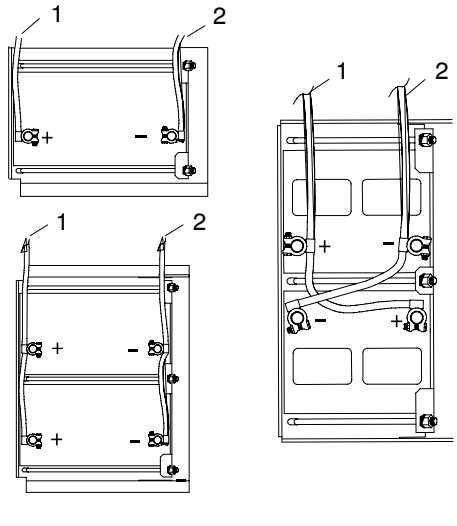
Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Refer to this section for general battery information and maintenance. All generator set models use a negative ground with a 12-volt or 24-volt engine electrical system. Consult the generator set nameplate for the engine electrical system voltage. Consult the generator set spec sheet for battery capacity recommendations for replacement purposes. The wiring diagrams provide battery connection information. See Figure 3-10, Figure 3-11, and Figure 3-12 for typical battery connections, including multiple battery configurations.

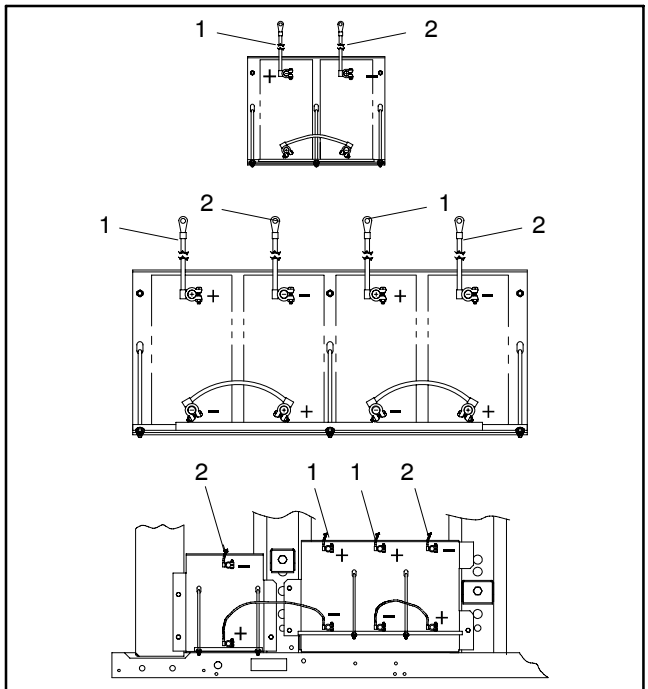
After reconnecting the battery cables, coat the terminals with petroleum jelly, silicon grease, or other nonconductive grease.

Note: Some units require a reflective heat shield insulative sleeve on the battery cables and other wires that are fastened to the starter solenoid. This sleeve is a conductive material and must be secured approximately 25 mm (1 in.) away from the exposed cable terminal.



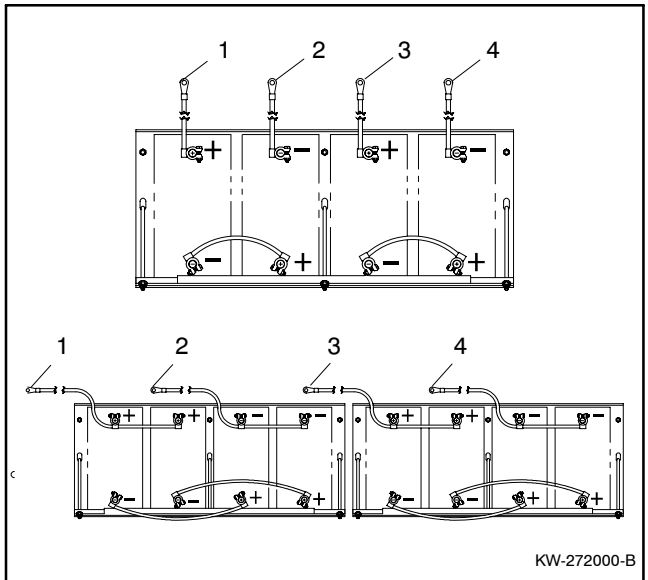
1. To positive (+) terminal on starter solenoid.
2. To ground (–) terminal on or near starter motor.

Figure 3-10 12-Volt Engine Electrical System Single Starter Motor Typical Battery Connection



1. To positive (+) terminal on starter solenoid.
2. To ground (–) terminal on or near starter motor.

Figure 3-11 24-Volt Engine Electrical System Single Starter Motor Typical Battery Connection



1. To positive (+) terminal on starter solenoid.
2. To ground (–) terminal on or near starter motor.
3. To positive (+) terminal on second starter solenoid.
4. To ground (–) terminal on or near second starter motor.

Figure 3-12 24-Volt Engine Electrical System Dual Starter Motors Typical Battery Connections

3.10.1 Cleaning

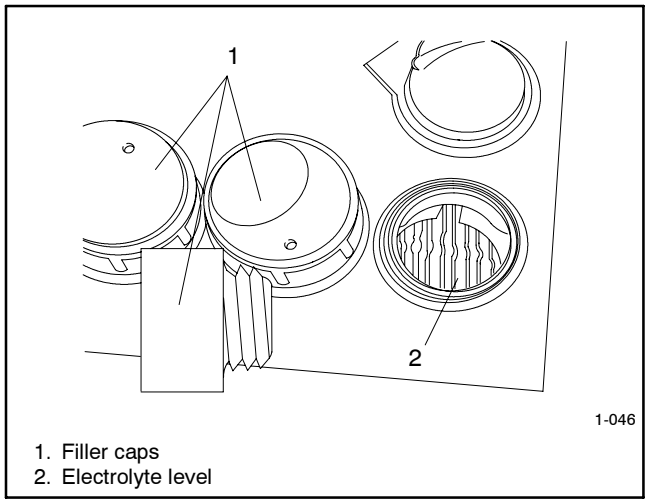
Clean the battery and cables and tighten the battery terminals according to the service schedule recommendations. Clean the battery by wiping it with a damp cloth. Keep electrical connections dry and tight.

If corrosion exists, disconnect the cables from the battery and remove the corrosion with a wire brush. Clean the battery and cables with a solution of baking soda and water. Do not allow the cleaning solution to enter battery cells. Flush the battery and cables with clean water and wipe the battery with a dry cloth.

3.10.2 Electrolyte Level Inspection

Check the electrolyte level and specific gravity of batteries that have filler caps. Maintenance-free batteries do not require electrolyte level checking or specific gravity testing.

Check the electrolyte level at the specified interval. Remove the filler caps and verify that the electrolyte level reaches the bottom of each filler hole. See Figure 3-13. Refill as necessary with distilled water or clean tap water. Do not add fresh electrolyte. Tighten the filler caps. After adding water during freezing temperatures, run the generator set 20–30 minutes to mix the electrolyte and the water to prevent battery damage from freezing.



1. Filler caps
2. Electrolyte level

Figure 3-13 Battery Electrolyte Level Inspection

3.10.3 Specific Gravity Check

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell of batteries with filler caps. Holding the hydrometer vertically, read the number on the glass bulb at the top of the electrolyte level or the number adjacent to the pointer. If the hydrometer used does not have a correction table, consult Figure 3-14.

Determine the specific gravity and electrolyte temperature of the battery cells. Locate the temperature in Figure 3-14 and correct the specific gravity by the amount shown. The battery is fully charged if the specific gravity is 1.260 at an electrolyte temperature of 26.7°C (80°F). Maintain the specific gravities between cells within ±0.01 of each other. Charge the battery if the specific gravity is below 1.215 at an electrolyte temperature of 26.7°C (80°F).

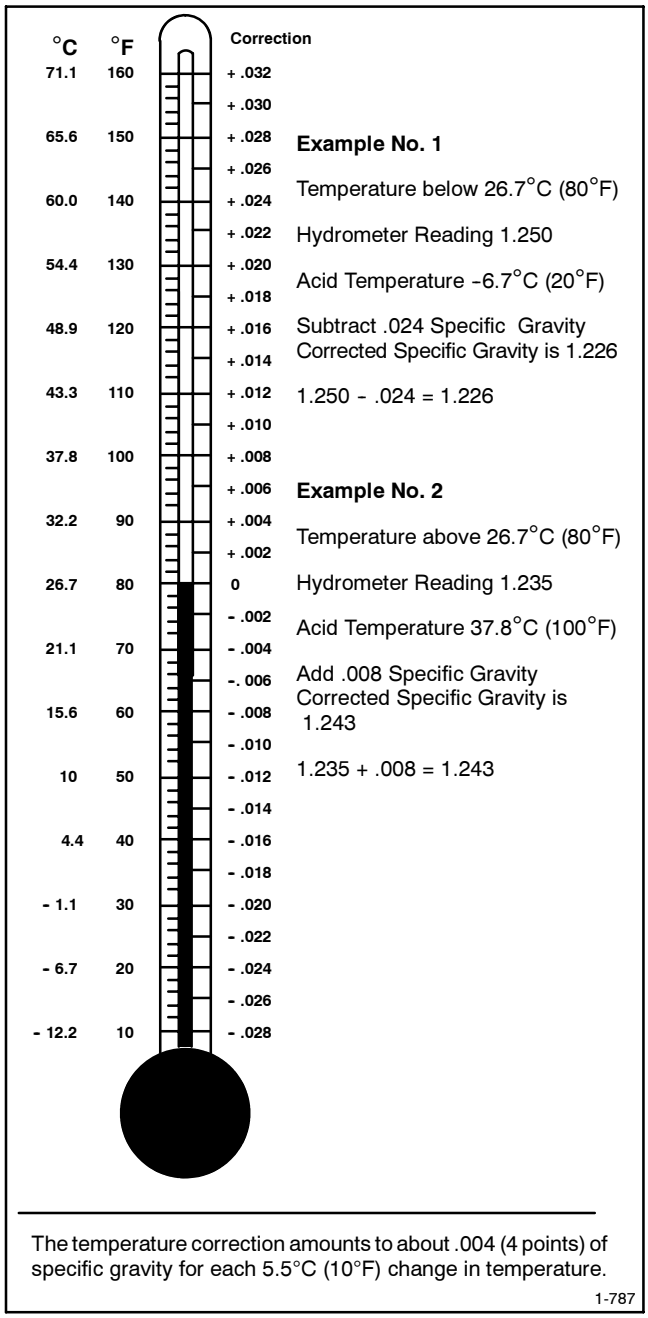


Figure 3-14 Specific Gravity Temperature Correction

Note: Some battery testers have four or five beads in a test tube. Draw electrolyte into the tube as with the battery hydrometer described in this section. Use the tester manufacturer's instructions. Figure 3-15 shows typical test results.

Number of Floating Beads	Battery Condition
5	Overcharged
4	Fully charged
3	A good charge
1 or 2	A low charge
0	A dead battery

Figure 3-15 Bead-Type Test Interpretation

3.10.4 Charging

Use a battery charger to maintain a fully charged battery when the generator set is used in a standby application. The engine battery-charging alternator charges the battery only while the generator set is running.

Note: If the generator set is in a temporary prime power application in which the generator set has periods of inactivity, the controller circuitry may drain the battery. If there is no power source for a battery charger, place the controller in the prime power mode, if equipped, or disconnect the battery from the generator set.

3.11 Detroit Diesel Engine Control Systems

Some generator sets equipped with Detroit Diesel engines use a DDEC/MDEC system. Access the DDEC control box inside the generator set junction box to retrieve codes when performing routine maintenance or troubleshooting the engine.

Note: DDC/MTU engines with MDEC requires the following method:

- Use a personal computer software package available from the manufacturer with a translator to access stored codes. Follow the instructions provided with the software.

Use the following data for informational purposes only. Consult the engine literature for complete information regarding operation and troubleshooting. See List of Related Materials in the Introduction section. Contact an authorized service distributor/dealer for service or diagnostic equipment.

3.11.1 Features

The DDEC/MDEC system optimizes control of critical engine functions and protects against serious engine damage resulting from conditions such as the following:

- Low coolant level
- Low coolant pressure
- High coolant temperature
- Low oil pressure
- High oil temperature

The major components of the DDEC/MDEC system include the electronic control module (ECM) and engine sensors. The DDEC control box is located in the generator set junction box.

3.11.2 DDEC Engine Diagnostics

The DDEC engine protection system monitors engine sensors and electronic components and recognizes system malfunctions. Critical faults light the check engine (CEL) and stop engine (SEL) lamps on the control box. ECM memory software logs malfunction codes. Consult the engine operation manual or engine service manual to identify the stored failure code. See Figure 3-16 for the DDEC control box features.

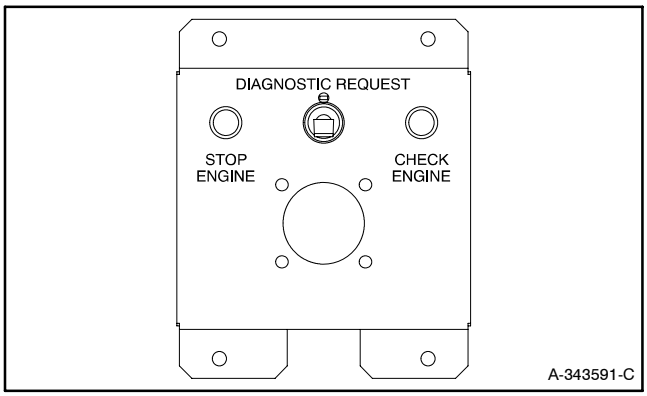


Figure 3-16 DDEC Control Box

Access the stored codes in one of three ways:

- Place the switch in the DIAGNOSTIC REQUEST position. The CEL or SEL flashes to identify the failure.

- Use a hand-held diagnostic data reader (DDR). Place the switch in the DIAGNOSTIC DATA READER position. Plug the DDR into the control box. The DDR displays the stored failure codes.

- Use a personal computer software package available from the manufacturer with a translator to access stored codes. Follow the instructions provided with the software.

Code Types

Active code. A code flashing on the SEL lamp indicates a fault currently exists.

Inactive code. A code flashing on the CEL lamp indicates a previous fault occurrence. The ECM memory stores inactive codes with time/date identification and the following information:

- First occurrence of each diagnostic code in engine operating hours.
- Last occurrence of each diagnostic code in engine operating hours.
- Total time in seconds that the diagnostic code was active.

3.12 Engine Control Systems

Some generator sets use an engine control system. Access the control box inside the generator set junction box to retrieve codes when performing routine maintenance or troubleshooting engine.

Use the following data for general informational purposes only. See the Engine Service Manual for complete information regarding operation and troubleshooting. Contact an authorized service distributor/dealer for service or diagnostic equipment.

Engine Control Features

Engine control is an advanced-technology, electronic engine control system. The system optimizes control of critical engine functions and provides protection against serious engine damage.

The major components include the engine control module, engine sensors, and control box located in the generator set junction box.

See Figure 3-17 for the John Deere engine control box features.

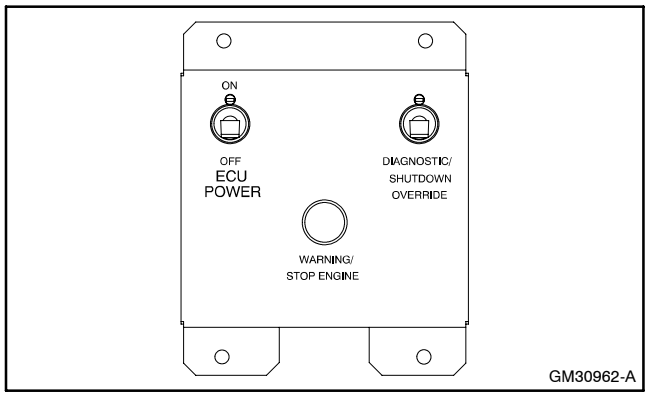


Figure 3-17 John Deere Engine Control Box

See Figure 3-18 for the Kohler-branded D300, D350, D400, D450, and D500 engine control box features.

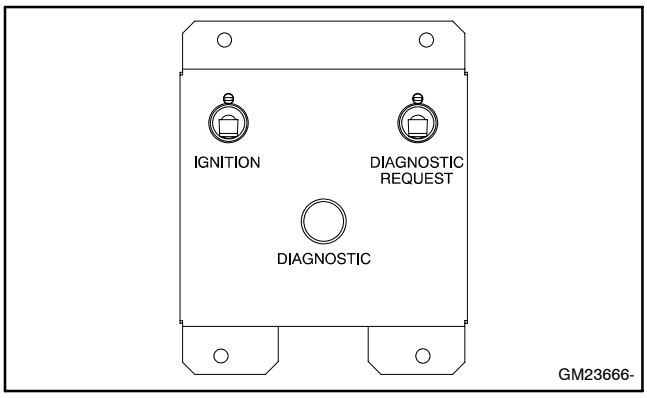


Figure 3-18 Kohler-Branded Engine Control Box

3.13 Storage Procedure

Perform the following storage procedure before taking a generator set out of service for three months or longer. Follow the engine manufacturer's recommendations, if available, for fuel system and internal engine component storage.

3.13.1 Lubricating System

Prepare the engine lubricating system for storage as follows:

1. Run the generator set for a minimum of 30 minutes to bring it to normal operating temperature.
2. Stop the generator set.
3. With the engine still warm, drain the oil from the crankcase.
4. Remove and replace the oil filter.
5. Refill the crankcase with oil suited to the climate.
6. Run the generator set for two minutes to distribute the clean oil.
7. Stop the generator set.
8. Check the oil level and adjust, if needed.

3.13.2 Cooling System

Prepare the cooling system for storage as follows:

1. Check the coolant freeze protection using a coolant tester.

2. Add or replace coolant as necessary to ensure adequate freezing protection. Use the guidelines included in the engine operation manual.

3. Run the generator set for 30 minutes to redistribute added coolant.

3.13.3 Fuel System

Prepare the fuel system for storage as follows:

Diesel-Fueled Engines

1. Fill the fuel tank with #2 diesel fuel.

2. Condition the fuel system with compatible additives to control microbial growth.

3. Change the fuel filter/separator and bleed the fuel system. See the engine owner's manual.

Gasoline-Fueled Engines

1. Add stabilizer to the fuel system. Follow the manufacturer's recommended procedure.

2. Run the generator set for 15 minutes to ensure that the stabilized fuel reaches the carburetor.

3. Place the generator set master switch in the OFF/RESET position.

4. Close the fuel valve.

Gas-Fueled Engines

1. Start the generator set.

2. With the generator set running, shut off the gas supply.

3. Run the generator set until the engine stops.

4. Place the generator set master switch in the OFF/RESET position.

3.13.4 Internal Engine Components (Gas/Gasoline-Fueled Engines)

If you have access to a fogging agent or SAE 10 oil prepare the pistons and cylinders for storage as follows:

1. While the engine is running, spray a fogging agent or SAE 10 engine oil into the air intake for about two minutes until the engine stops.

2. Place the generator set master switch in the OFF/RESET position.

If a fogging agent is not available perform the following:

1. Remove the spark plugs.

2. Pour 15 cc (0.5 oz.) of engine oil into each spark plug hole.

   Ignition System Damage. Refer to the engine operation manual for ignition system precautions before cranking the engine while the spark plug wires are disconnected.

3. Toggle the generator set master switch to crank the engine two or three revolutions to lubricate the cylinders.

4. Reinstall the spark plugs and torque them to specifications.

3.13.5 Exterior

1. Clean the exterior surface of the generator set.

2. Seal all engine openings except for the air intake with nonabsorbent adhesive tape.

3. To prevent impurities from entering the air intake and to allow moisture to escape from the engine, secure a cloth over the air intake.

4. Mask electrical connections.

5. Spread a light film of oil over unpainted metallic surfaces to inhibit rust and corrosion.

3.13.6 Battery

Perform battery storage after all other storage procedures.

1. Place the generator set master switch in the OFF/RESET position.

2. Disconnect the battery(ies), negative (-) lead first.

3. Clean the battery. Refer to Section 3.10.1 for the battery cleaning procedure.

4. Place the battery in a cool, dry location.

5. Connect the battery to a float/equalize battery charger or charge it monthly with a trickle battery charger. Refer to the battery charger manufacturer's recommendations.

   Maintain a full charge to extend battery life.

Section 4 Troubleshooting

This section contains generator set troubleshooting, diagnostic, and repair information.

Use the chart on the following page to diagnose and correct common problems. First check for simple causes such as a dead engine starting battery or an open circuit breaker. The chart includes a list of common problems, possible causes of the problem, recommended corrective actions, and references to detailed information or repair procedures.

Maintain a record of repairs and adjustments performed on the equipment. If the procedures in this manual do not explain how to correct the problem, contact an authorized distributor/dealer. Use the record to help describe the problem and repairs or adjustments made to the equipment.

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Controller												
x	x									Controller circuit board(s) inoperative	Replace the controller circuit board.	Gen. S/M
				x						Controller fault	Troubleshoot the controller.†	Gen. S/M
x	x			x						Controller fuse blown	Replace the blown controller fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D
x										Controller master switch inoperative	Replace the controller master switch.	—
x										Controller master switch in the OFF/RESET position	Move the controller master switch to the RUN or AUTO position.	Section 2
x										Engine start circuit open	Move the controller master switch to the RUN position to test the generator set. Troubleshoot the auto start circuit and time delays.	Section 2, W/D, Gen. I/M, S/M ATS O/M, S/M
x										Controller interface to engine ECM	Check engine ECM and electrical wiring.	Eng. S/M, W/D
Cooling System												
						x		x		Air openings clogged	Clean the air openings.	—
						x				Coolant level low	Restore the coolant to normal operating level.	Section 3
						x				Cooling water pump inoperative	Tighten or replace the belt. Replace the water pump.	Eng. O/M or S/M
				x						High temperature shutdown	Allow the engine to cool down. Then troubleshoot the cooling system.	Sec. 3, Eng. O/M
				x						Low coolant level shutdown, if equipped	Restore the coolant to normal operating level.	Section 3
						x				Thermostat inoperative	Replace the thermostat.	Eng. S/M
Electrical System (DC circuits)												
x	x									Battery connections loose, corroded, or incorrect	Verify that the battery connections are correct, clean, and tight.	Section 3
x	x									Battery weak or dead	Recharge or replace the battery. The spec sheet provides recommended battery CCA rating.	Section 3, S/S
x	x									Starter/starter solenoid inoperative	Replace the starter or starter solenoid.	Eng. S/M
x				x						Engine harness connector(s) not locked tight	Disconnect the engine harness connector(s) then reconnect it to the controller.	W/D
				x						High water temperature switch inoperative	Replace the inoperative switch.	Gen. S/M or W/D
				x						Fault shutdown	Reset the fault switches and troubleshoot the controller.	Section 2
				x						High exhaust temperature switch inoperative	Replace the inoperative switch.	Gen. S/M or W/D

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram Manual

† Have an authorized service distributor/dealer perform this service.

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Engine												
x										Engine ECM	Troubleshoot engine ECM and electrical.	Eng. S/M, W/D
	x	x			x			x		Air cleaner clogged	Clean or replace the filter element.	Eng. O/M
	x	x				x		x	x	Compression weak	Check the compression.†	Eng. S/M
			x		x	x		x	x	Engine overload	Reduce the electrical load. See the generator set spec sheet for wattage specifications.	S/S
									x	Exhaust system leak	Inspect the exhaust system. Replace the inoperative exhaust system components.†	I/M
									x	Exhaust system not securely installed	Inspect the exhaust system. Tighten the loose exhaust system components.†	I/M
		x	x		x			x		Governor inoperative	Adjust the governor.†	Gen. S/M
					x				x	Valve clearance incorrect	Adjust the valves.†	Eng. S/M
									x	Vibration excessive	Tighten all loose hardware.	—
	x	x			x					Ignition system inoperative (gas/gasoline only)	Check the ignition system (spark plugs, spark plug wires, etc.).	Eng. O/M
Fuel System												
	x	x			x					Air in fuel system (diesel only)	Bleed the diesel fuel system.	Eng. O/M
	x	x								Ether canister empty or system inoperative, if equipped (diesel only)	Replace or repair the ether starting system.	Eng. O/M
	x			x						Fuel tank empty or fuel valve shut off	Add fuel and move the fuel valve to the ON position.	—
	x				x			x		Fuel feed or injection pump inoperative (diesel only)	Rebuild or replace the injection pump.†	Eng. S/M
	x	x			x					Fuel or fuel injectors dirty or faulty (diesel only)	Clean, test, and/or replace the inoperative fuel injector.†	Eng. S/M
	x	x		x	x					Fuel filter restriction	Clean or replace the fuel filter.	Eng. O/M
	x									Fuel solenoid inoperative	Troubleshoot the fuel solenoid.†	Eng. S/M
	x				x					Fuel pressure insufficient (gas only)	Check the fuel supply and valves.†	S/S, Gen. O/M
	x	x			x			x		Fuel injection timing out of adjustment (diesel only)	Adjust the fuel injection timing.†	Eng. S/M

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram Manual

† Have an authorized service distributor/dealer perform this service.

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Alternator												
			x							AC output circuit breaker open	Reset the breaker and check for AC voltage at the generator side of the circuit breaker.	—
x										Transfer switch test switch in the OFF position	Move the transfer switch test switch to the AUTO position.	ATS O/M
			x							Transfer switch fails to transfer load	Move the ATS test switch to the AUTO position. Troubleshoot the transfer circuit and time delays.	ATS O/M, S/M
			x							Wiring, terminals, or pin in the exciter field open	Check for continuity.	Gen. S/M, W/D
			x							Main field (rotor) inoperative (open or grounded)	Test and/or replace the rotor.†	Gen. S/M
			x							Stator inoperative (open or grounded)	Test and/or replace the stator.†	Gen. S/M
									x	Vibration excessive	Tighten loose components.†	—
			x	x						Voltage regulator digital settings incorrect (digital controller only)	Adjust the voltage regulator.	Sec. 2, Menu 11
			x	x						Voltage regulator inoperative	Replace the voltage regulator fuse, If the fuse blows again, troubleshoot the voltage regulator.	Gen. S/M
			x	x						Voltage regulator out of adjustment	Adjust the voltage regulator.	Gen. S/M
Lube System												
	x	x					x		x	Crankcase oil type incorrect for ambient temperature	Change the oil. Use oil with a viscosity suitable for the operating climate.	Eng. O/M
						x	x		x	Oil level low	Restore the oil level. Inspect the generator set for oil leaks.	Eng. O/M
				x						Low oil pressure shutdown	Check the oil level.	Eng. O/M

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram Manual

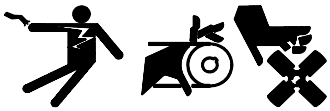
† Have an authorized service distributor/dealer perform this service.

To change the voltage of 10- or 12-lead generator sets, use the following voltage reconnection procedure. Adjust the governor and voltage regulator for frequency changes. Consult the generator set service manual for frequency adjustment information.

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/ dealer.

Equipment damage. Verify that the voltage ratings of the transfer switch, line circuit breakers, and other accessories match the selected line voltage.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Turn the generator set master switch and switchgear engine control switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by an automatic transfer switch or a remote start/stop switch.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

⚠ WARNING

Hazardous voltage. Moving parts.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Reconnect the generator set stator leads to change the output phase or voltage. Refer to the following procedure and the connection schematics shown in Figure 5-1, Figure 5-2, Figure 5-3, and Figure 5-4 Follow the safety precautions at the front of this manual and in the text and observe National Electrical Code (NEC) guidelines.

Voltage Reconnection Procedure

1. Place the generator set master switch in the OFF/RESET position.

2. Disconnect the generator set engine starting battery, negative (-) lead first. Disconnect power to the battery charger (if equipped).

3. Use Figure 5-1, Figure 5-2, Figure 5-3, and Figure 5-4 to determine the generator set voltage configuration. Note the original voltage and reconnect as needed. Route leads through current transformers (CTs) and connect them according to the diagram for desired phase and voltage.

   Note: Position current transformers CT1, CT2, and CT3 with the dot or HI side toward the generator set.

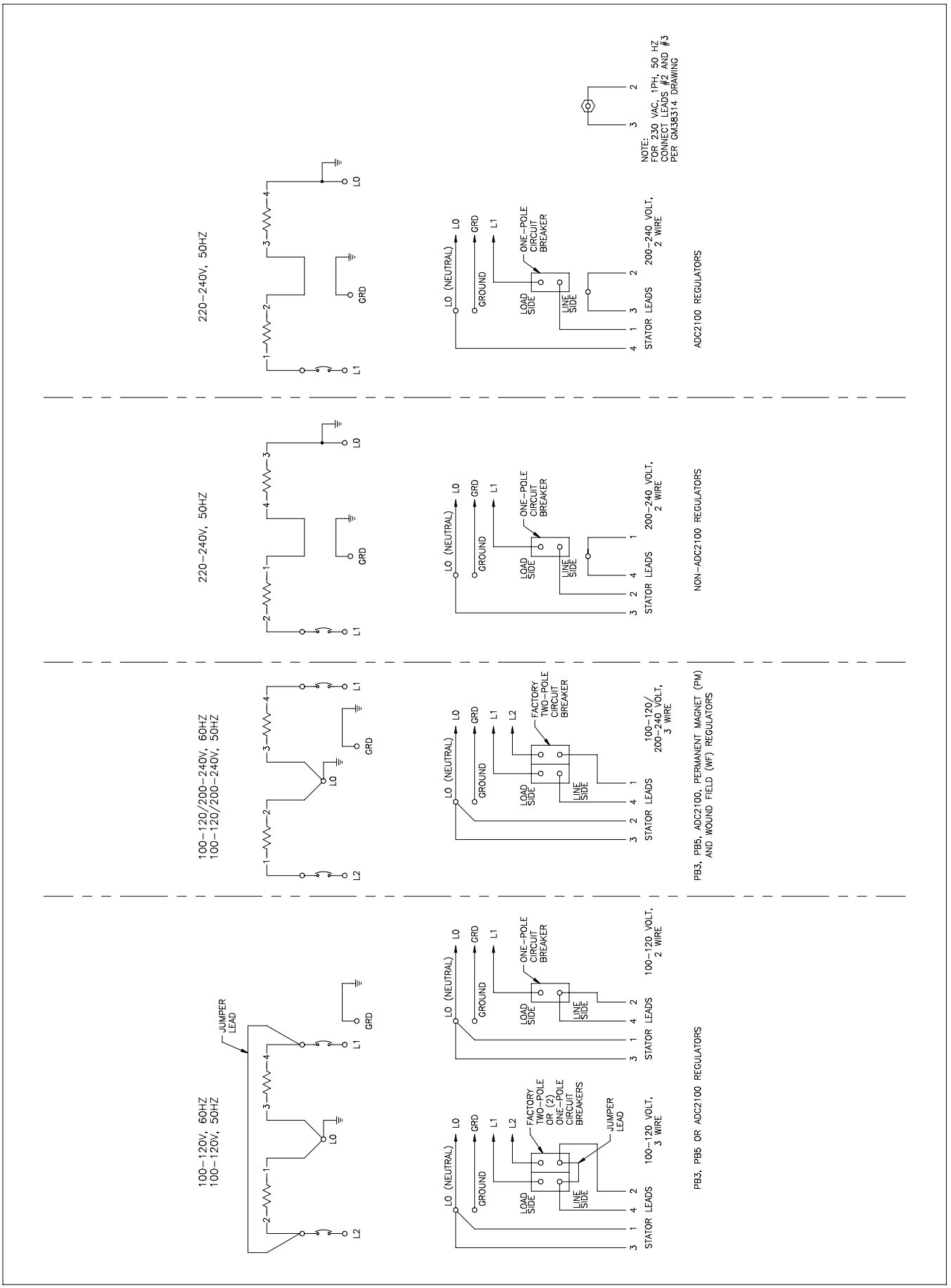
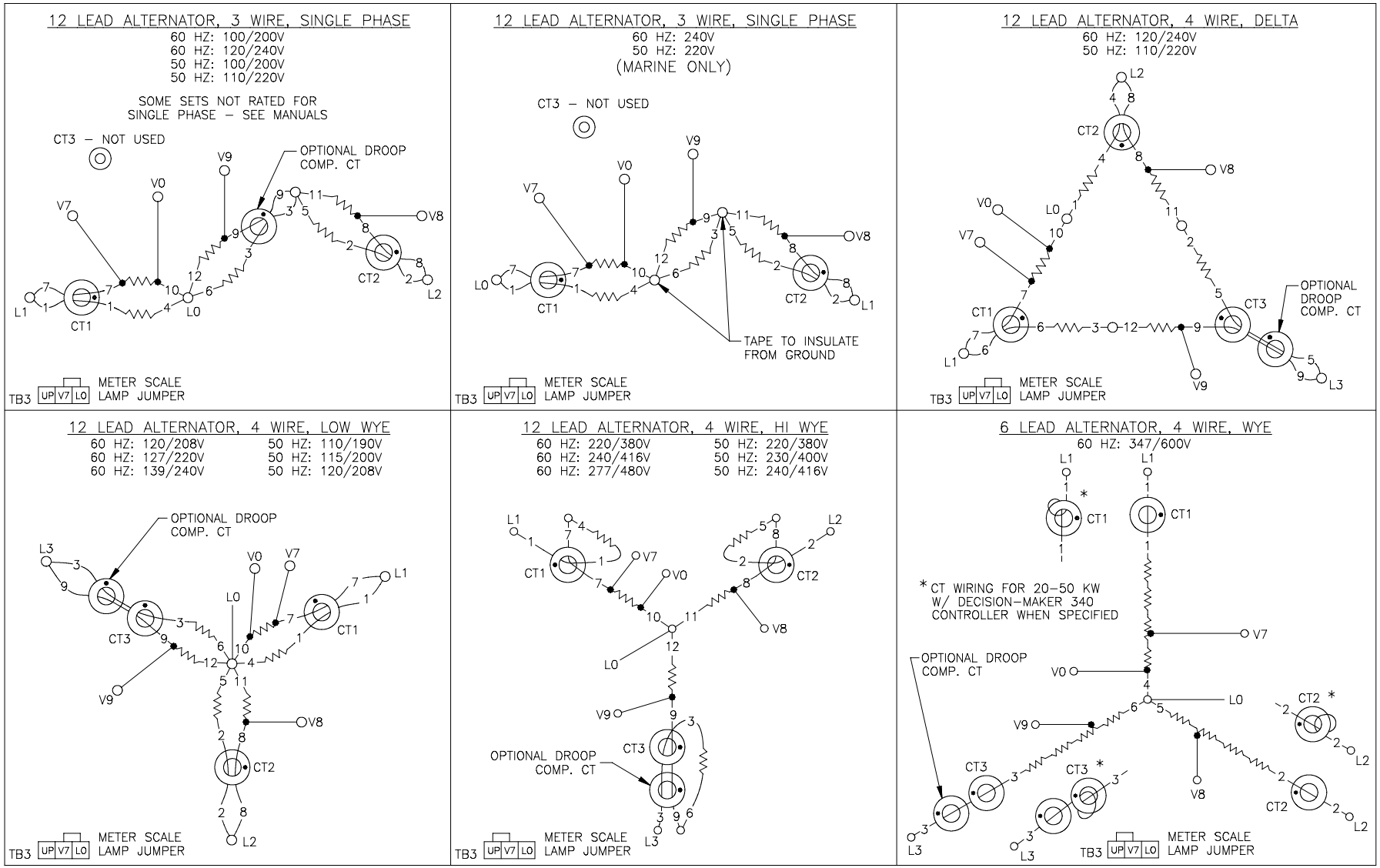


Figure 5-1 20–150 kW Permanent Magnet and Wound Field Single-Phase Alternators, ADV-5875A-H

Figure 5-2 20-300 kW Permanent Magnet and 20-60 kW Wound Field Alternators, ADV-5875B-H



NOTES:

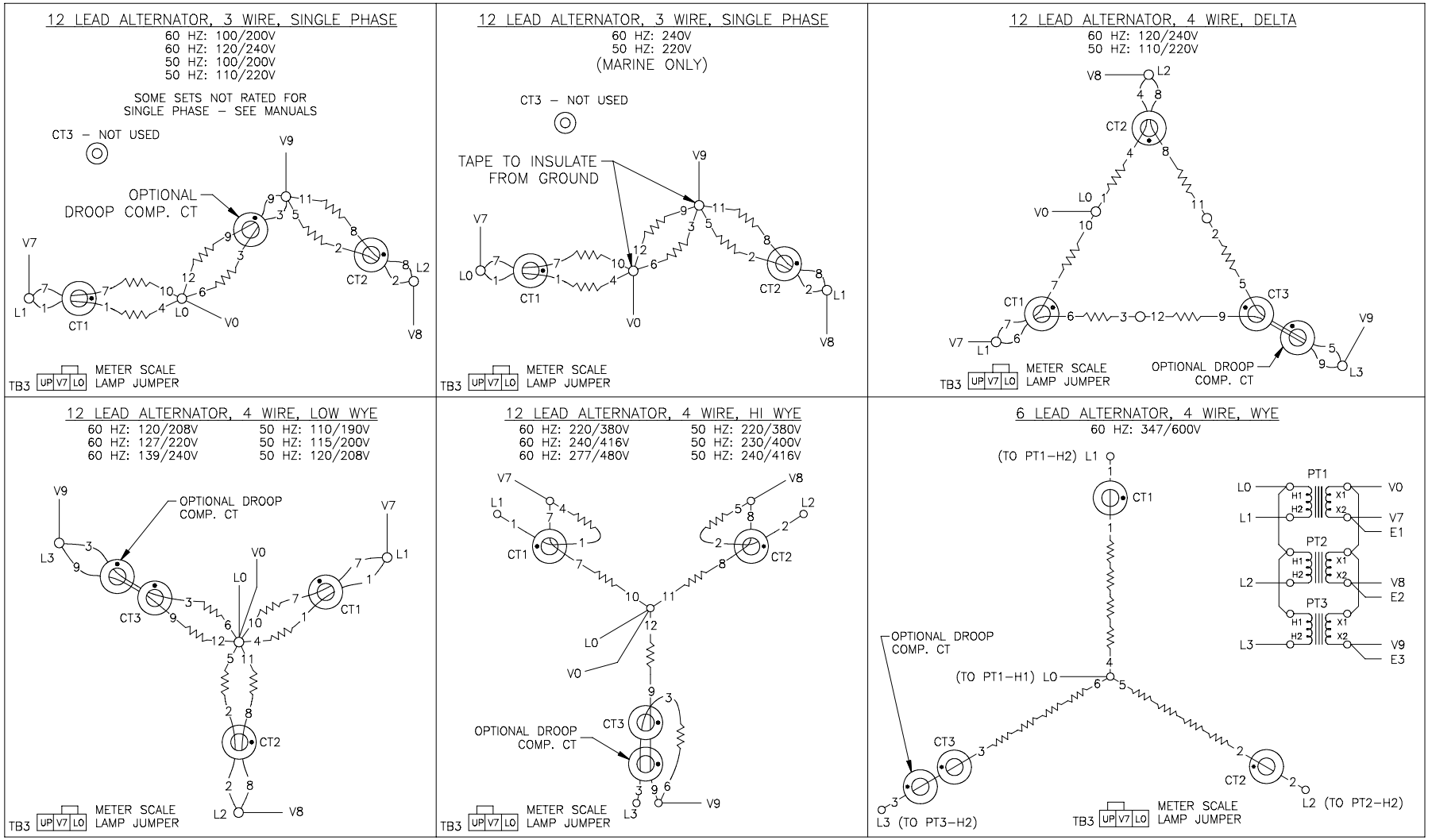
CURRENT TRANSFORMER DOT OR "H1" TOWARD GENERATOR.

CURRENT TRANSFORMERS NOT USED ON ALL SETS.

PHASE ROTATION

A	B	C
L1	L2	L3

Figure 5-3 60 (with Oversize Alternator)-300 kW Wound Field Alternators, ADV-5875C-H



NOTES:
CURRENT TRANSFORMER DOT OR "H1" TOWARD GENERATOR.
CURRENT TRANSFORMERS NOT USED ON ALL SETS.

PHASE ROTATION

A	B	C
L1	L2	L3

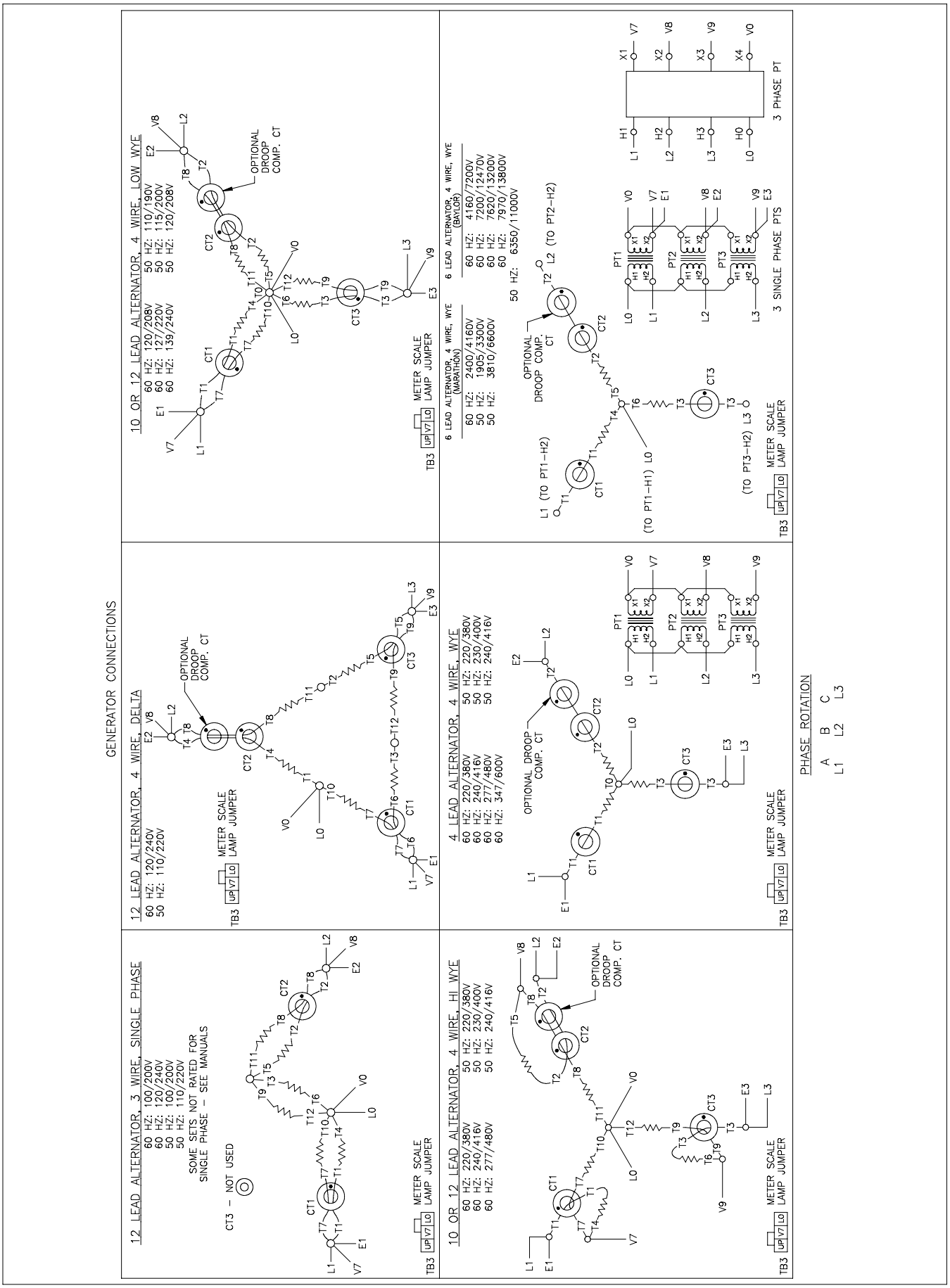
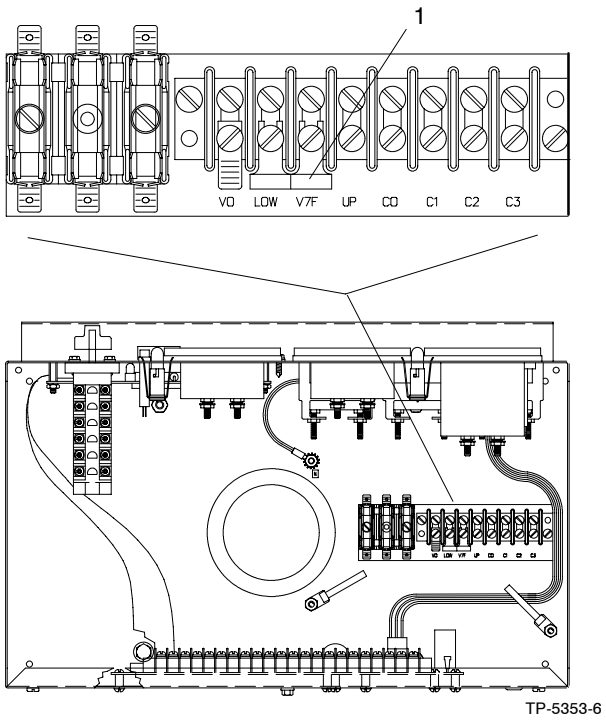


Figure 5-4 350–2000 kW Pilot-Excited, Permanent Magnet Alternator, ADV-5875D-H

4. Remove the controller cover and reposition the meter scale lamp jumper (see Figure 5-5) to match the position for desired voltage (shown in Figure 5-1, Figure 5-2, Figure 5-3, and Figure 5-4). Replace the controller cover.



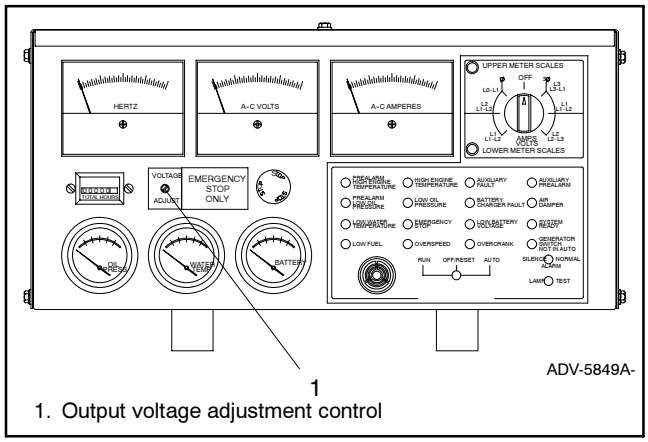
1. Lamp Jumper

Figure 5-5 Meter Scale Lamp Jumper

5. Set the phase selector switch to the L1-L2 position (1-phase or 3-phase depending on generator set connection). Connect a voltmeter across leads L1 and L2 if the controller has no meters.

6. Reconnect the starting battery, negative (-) lead last. Place the generator set master switch in the RUN position to start the generator set. Check the voltmeter to verify that the voltage changed to the desired value.

   a. 20–300 kW Models: Adjust the voltage with the voltage adjustment control on the generator set controller front panel (or switchgear). See Figure 5-6.



1. Output voltage adjustment control

Figure 5-6 Voltage Adjustment

   b. 350–2000 kW Models: Adjust the voltage with the voltage adjustment control on the voltage regulator (or switchgear). Use the applicable technical manual for voltage regulator adjustment.

7. Stop the generator set after completing the voltage adjustment. Replace the controller cover.

6.1 Accessories

Several electrical accessories and controls help finalize installation, add convenience to operation and service, and establish state and local code compliance.

Accessories vary with each generator set model and controller. Select factory-installed and/or shipped-loose accessories. Kit and installation instruction part numbers change. Obtain the most current accessory information from your local authorized service distributor/dealer.

This section illustrates several accessories available at the time of print of this publication. Accessory kits generally include installation instructions. See the wiring diagrams manual for electrical connections not shown in this section. See the installation instructions and drawings supplied with the kit for information on the kit mounting location.

The instructions provided with the accessory kit supersede these instructions where there are differences. In general, run AC and DC wiring in separate conduit. Use shielded cable for all analog inputs. Observe all applicable national, state, and local electrical codes during accessory installation.

Note: The accessories with the (M) notation are available only on models with 16-light microprocessor controllers.

6.1.1 Audiovisual Alarm (M)

An audiovisual alarm warns the operator of fault shutdowns and prealarm conditions (except battery charger fault and low battery voltage) from a remote location. Audiovisual alarms include an alarm horn, an alarm silence switch, and a common fault lamp. See Figure 6-1.

Note: Use the audiovisual alarm with a dry contact kit.

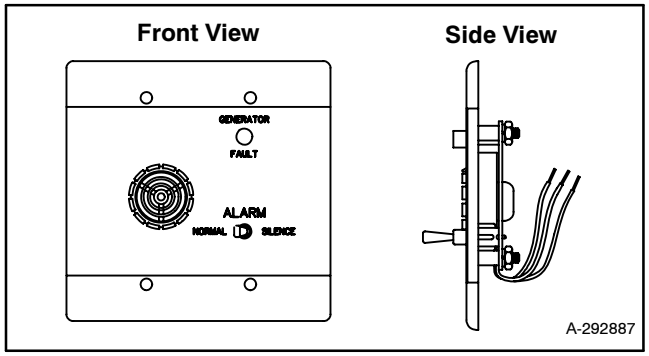


Figure 6-1 Audiovisual Alarm

6.1.2 Common Failure Relay Kit (M)

The common failure relay kit provides one set of contacts to trigger user-provided warning devices if a fault occurs. The common failure relay faults are user-defined.

Connect up to three common failure relay kits to the controller output. See Figure 6-2. See Section 6.2, Accessory and Prime Power Terminal Strip Connections, for terminal identification.

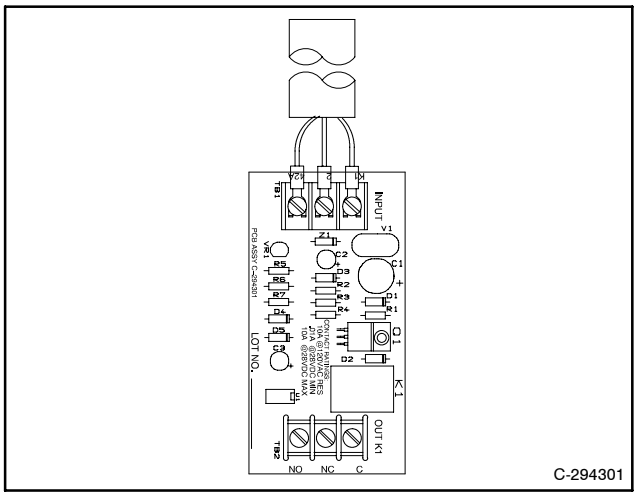


Figure 6-2 Common Failure Relay Kit

6.1.3 Controller Connection Kit (M)

The controller connection kit allows easy connection of controller accessories without accessing the controller terminal strip. The kit uses a 165-cm (65-in.) wiring harness to link the controller terminal strip(s) with a remote terminal strip located in the generator set junction box. With the exception of a few terminals the remote terminal strip is identical to that of the controller. Connect all accessories except the emergency stop kit to the connection kit terminal strip.

6.1.4 Dry Contact Kit (Single-Relay) (M)

The single-relay dry contact kit uses one set of contacts to trigger customer-provided warning devices if a fault condition occurs. Connect any controller fault output connection from the TB1 terminal strip to the single-relay kit. Use the single-relay dry contact kit as a common fault relay for signaling any of the following common fault conditions:

- Emergency Stop
- Auxiliary
- Overspeed
- Low Oil Pressure
- High Engine Temperature

Connect a maximum of three dry contact kits to a single controller output. See Figure 6-3.

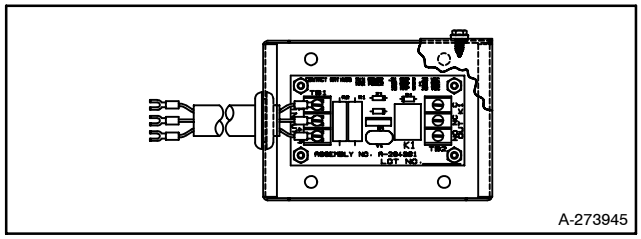


Figure 6-3 Single-Relay Dry Contact Kit, Typical

6.1.5 Dry Contact Kits (10-, 14-, and 20-Relay) (M)

Dry contact kits allow monitoring of the generator set system and provide the ability to activate warning devices and other customer-provided accessories. Available kits include 10, 14, or 20 sets of relay contacts for connecting customer-provided devices to desired generator set functions. The 20-relay kits can be used on 450 kW and larger generator sets. The 10-relay and 20-relay kits provide normally open and normally closed contacts. The 14-relay kit provides normally open contacts only.

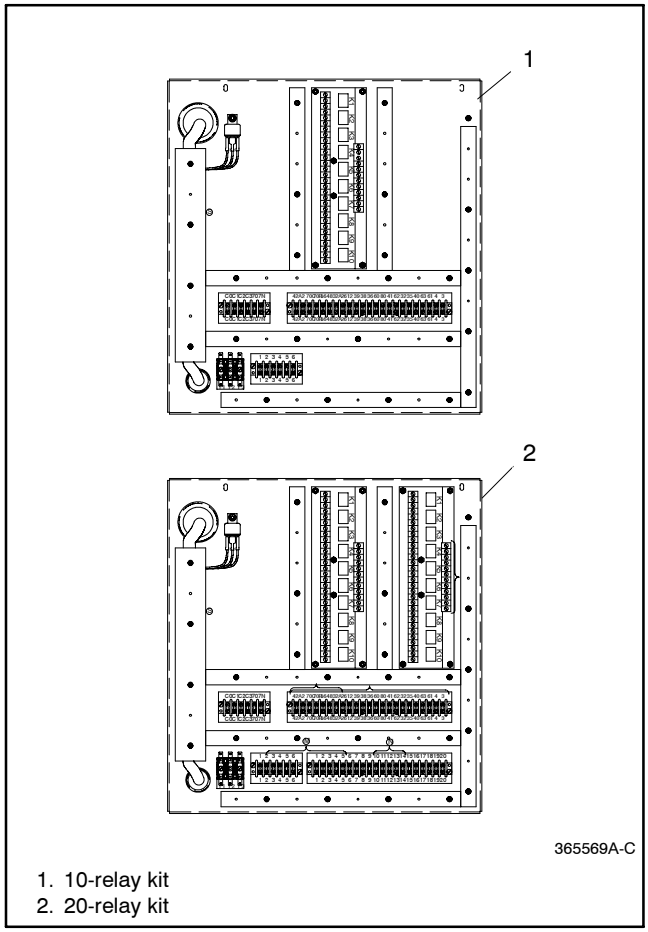
Warning devices (lamp and/or audible alarms) and other accessories typically connect to the controller output connections listed below. A total of three dry contact kits may connect to a specific output connection on the controller. Figure 6-4 shows some typical dry contact kits mounted on an assembly panel for 450 kW and larger generator sets.

Typical 10- and 14-relay contact kit output connections include:

- Overspeed
- Overcrank
- High engine temperature
- Low oil pressure
- Low water temperature
- Auxiliary fault
- Anticipatory high engine temperature
- Anticipatory low oil pressure
- Emergency stop

Additional connections available with the 20-relay kits include:

- Battery charger fault
- Low battery voltage
- Low fuel level
- Engine trouble
- Not in AUTO
- System ready
- Common fault
- Overcrank
- Crank terminate
- Cooldown



1. 10-relay kit
2. 20-relay kit

Figure 6-4 Dry Contact Kits (shown mounted on assembly panel for 450 kW and larger generator sets)

6.1.6 Engine Prealarm Senders (M)

Alert the user of low water temperature, approaching low oil pressure, and approaching high engine temperature. Kits for gas-fueled models include a low fuel pressure switch.

6.1.7 FASTCHECK Diagnostic Tester (M)

The FASTCHECK® diagnostic tester simulates engine operation to identify faults in the controller and engine circuitry. Use the FASTCHECK® when troubleshooting startup problems or to test and troubleshoot the controller when it is removed from the generator set. Perform tests without starting the generator set. FASTCHECK® functions are listed below; refer to Figure 6-5 to identify LEDs and switches.

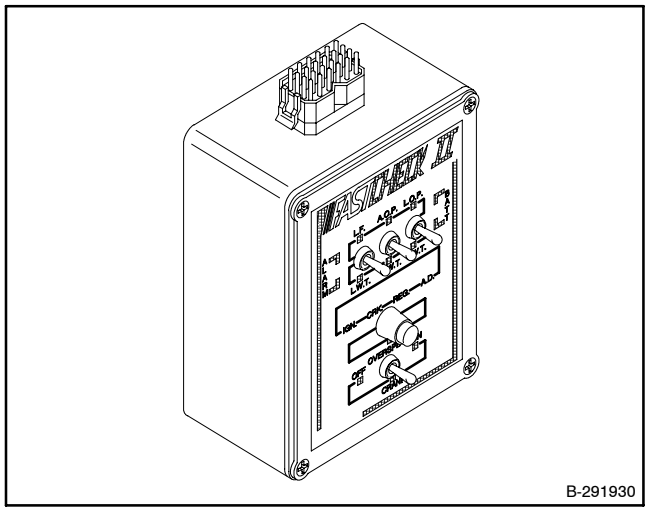


Figure 6-5 FASTCHECK® Diagnostic Tester

LEDs on the FASTCHECK® illuminate to indicate the energizing of the following circuits:

- AC Voltage Regulator
- Battery Connection (correct polarity)
- Engine Ignition (gas/gasoline)
- Engine Crank
- Engine Antidieseling
- Engine Malfunction Alarm and/or Alarm Shutdown
- Fuel Solenoid (diesel)

Switches on the FASTCHECK® simulate the following:

- Anticipatory High Engine Coolant Temperature
- Anticipatory Low Engine Oil Pressure
- Engine Crank
- Engine Overspeed
- Engine Running
- High Engine Coolant Temperature
- Low Engine Coolant Temperature
- Low Engine Oil Pressure
- Low Fuel

6.1.8 Float/Equalize Battery Charger Kit with Alarm Option (M)

The float/equalize battery charger with alarm option provides battery charging to the engine starting battery(ies) and connects to the controller for fault detection. Battery chargers for 12- or 24-volt models are available as a generator set accessory.

See Figure 6-6. See Section 6.2, Accessory and Prime Power Terminal Strip Connections, for terminal identification.

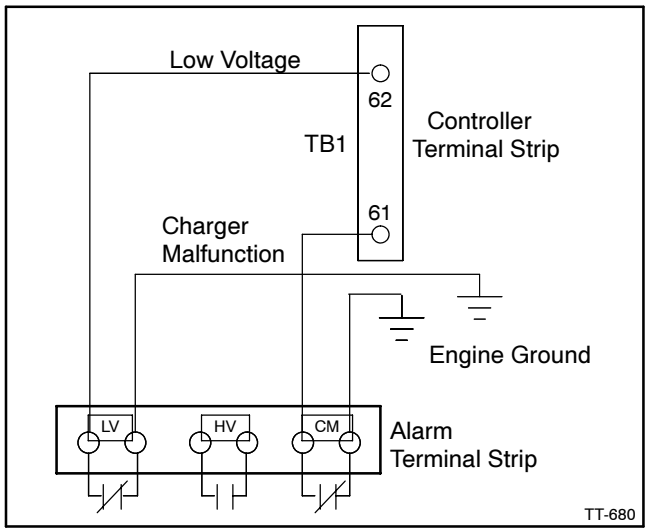


Figure 6-6 Float/Equalize Battery Charger Connections

6.1.9 Line Circuit Breaker

The line circuit breaker interrupts generator output if an overload or short circuit occurs. Use the line circuit breaker to manually disconnect the generator set from the load during generator set service. See Figure 6-7.

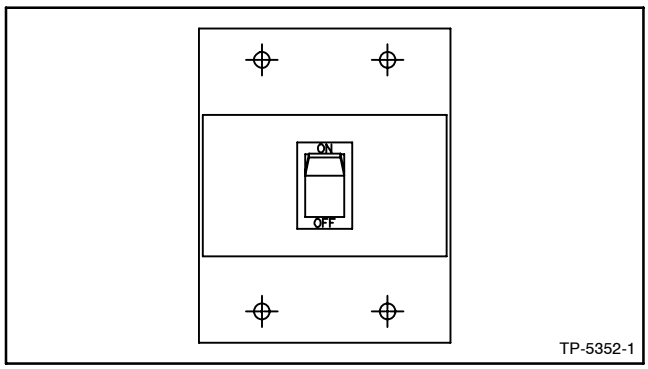


Figure 6-7 Line Circuit Breaker

6.1.10 Low Fuel Switch (M)

Some gaseous-fueled models offer a low fuel pressure switch as part of the Engine Prealarm Senders kit. The low fuel pressure switch connects to the same terminal as the low fuel *level* switch on diesel- or gasoline-fueled models. See Figure 6-8 and Figure 6-9. See Section 6.2, Accessory and Prime Power Terminal Strip Connections, for terminal identification.

Note: The subbase fuel tank or main tank may include the low fuel level switch. The fuel tank supplier typically provides the low fuel level switch.

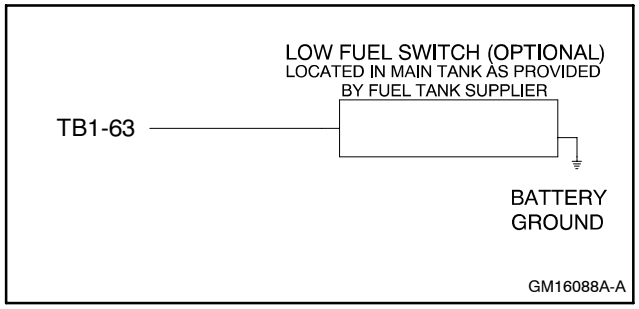


Figure 6-8 Low Fuel Switch (Level or Pressure)

Switch Rating	12 volts DC minimum, 0.5 amp minimum
Wiring Recommendation	
Gauge	**mm (ft.)**
18–20	30.5 (100)
14	153 (500)
10	305 (1000)

Figure 6-9 Switch Rating and Wiring Recommendation

6.1.11 Remote Annunciator Kit (M)

A remote annunciator provides convenient monitoring of the generator set's condition from a remote location. See Figure 6-10. The remote annunciator includes an alarm horn, alarm silence switch, lamp test, and the same lamp indicators (except air damper) as the 16-light controller, plus the following lamps:

Line Power lamp illuminates to indicate that the commercial utility is the power source.

Generator Power lamp illuminates to indicate that the generator set is the power source.

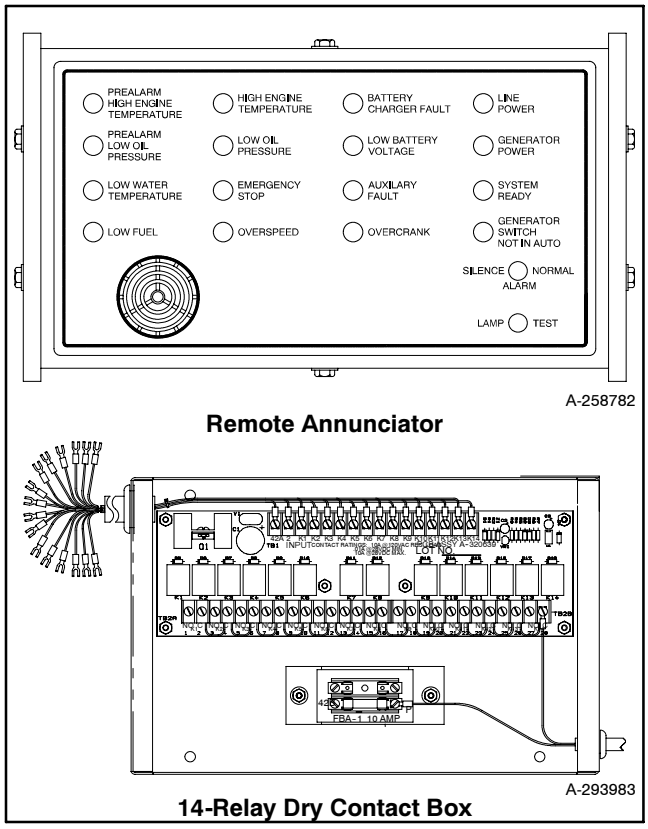


Figure 6-10 Remote Annunciator with 14-Relay Dry Contact Box

6.1.12 Remote Emergency Stop Kit (M)

The emergency stop kit shuts down the generator set from a remote location in an emergency. See Figure 6-11. Activating the emergency stop switch lights the EMERGENCY STOP lamp and shuts down the unit. Before restarting the generator set, reset emergency stop switch by replacing the glass piece and reset the generator set by placing the master switch in the OFF/ RESET position. The switch holds a single replacement glass piece, which is available as a service part.

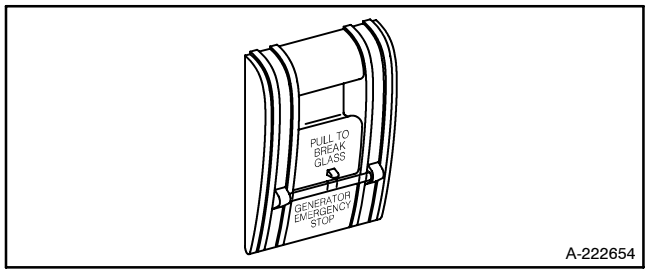


Figure 6-11 Emergency Stop Kit

6.1.13 Remote Serial Annunciator (M)

The remote serial annunciator monitors the condition of the generator set from a location remote from the generator set. If a generator alarm condition occurs, the remote annunciator alerts the operator through visual and audible signals using a RS-485 controller connection. See Figure 6-12. Requires a controller communication module kit installed in the controller. See Figure 6-13.

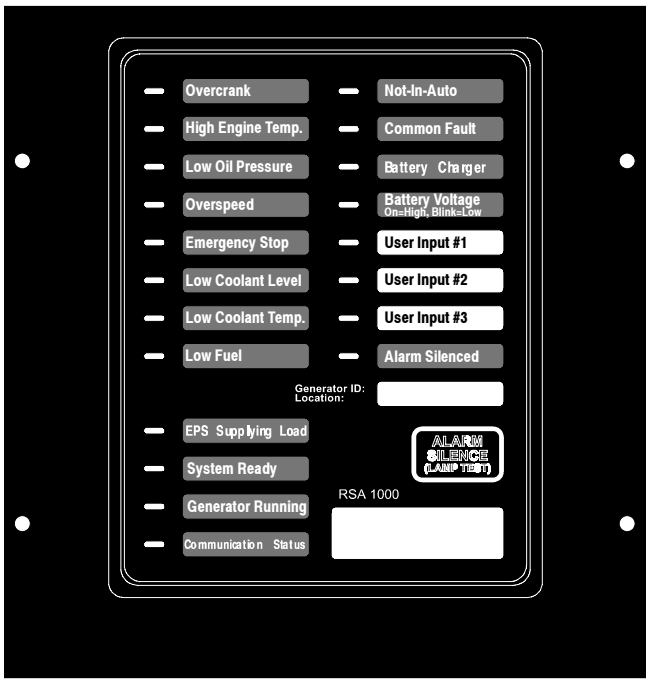
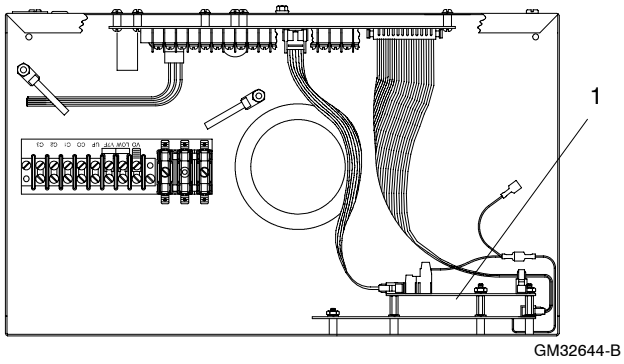


Figure 6-12 Remote Serial Annunciator (RSA)



1. Communication circuit board GM47242 or GM49791-1

Note: Circuit board GM 49791-2 is a gauge driver and is not a communications circuit board.

Figure 6-13 16-Light Controller with Installed Comm. Module (controller top view)

6.1.14 Run Relay Kit

The run relay kit includes three sets of contacts that energize only during generator set operation. The run relay kit can control air intake louvers, radiator louvers, alarms, and other signaling. See Figure 6-14.

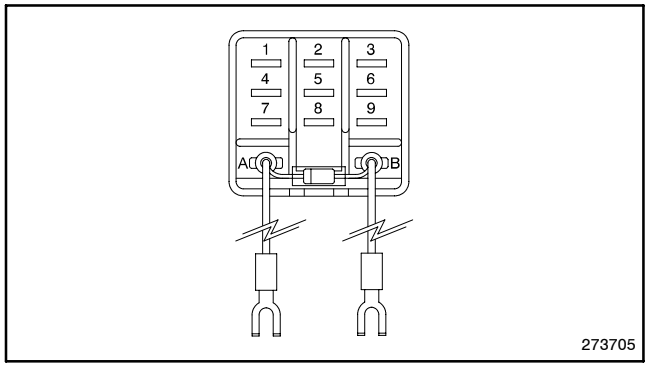


Figure 6-14 Run Relay Kit

6.1.15 Safeguard Breaker

The safeguard breaker senses output current on each generator phase and shuts off the AC voltage regulator if a sustained overload or short circuit occurs. It is not a line circuit breaker and does not disconnect the generator set from the load. See Figure 6-15.

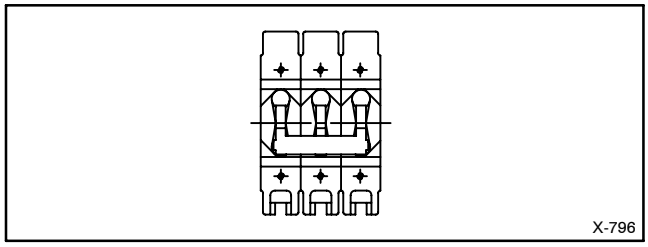


Figure 6-15 Safeguard Breaker

6.2 Accessory and Prime Power Terminal Strip Connections (M)

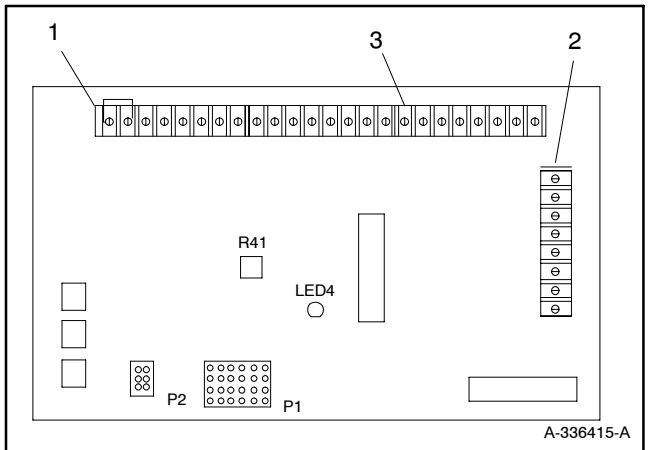
The 16-light controller circuit board has terminal strips for use in connecting a controller connection kit. Do not connect accessories directly to the controller terminal strip(s). Connect accessories to either a controller connection kit or dry contact kit. Connect the dry contact kit(s) to the controller connection kit. Connect alarms, battery chargers, remote switches, and other accessories to the dry contact kit relay(s).

The 16-light controller has two terminal strips, TB1 and TB2, on the controller circuit board, and prime power choices are made on TB2. See Figure 6-16 for controller configurations. See Figure 6-17 and Figure 6-18 for controller terminal strip identification.

Lower the controller circuit board panel until it is lying flat when connecting the dry contact kits to the controller TB1 terminal strip. Route dry contact relay leads through the controller grommet and guide loops to the circuit board terminal strip. Place the controller circuit board panel flat to ensure adequate slack in the dry contact relay leads. For specific information on accessory connections refer to the accessory wiring diagrams in the Wiring Diagram Manual and the instruction sheet accompanying the kit.

Note: Not all terminals are used for all generator sets (see appropriate wiring diagrams for specific generator set models).

Note: To use the prime power mode, use jumpers to connect TB2-1P to TB2-2P, TB2-3P to TB2-4P, and TB2-3 to TB2-4. To deactivate the prime power mode, remove these jumpers.



1. TB1 (TB1A) terminal strip
2. TB2 terminal strip
3. TB3 (TB1B) terminal strip

Figure 6-16 TB1 and TB2 Terminal Strips on the 16-Light Controller

Terminal	Purpose
1P	Prime power operation.
2P	Prime power operation.
3	Remote start ground. Connect transfer switch or remote start switch to TB2-3 and TB2-4.
3P	Prime power operation.
4	Remote start. Connect transfer switch or remote start switch to TB2-3 and TB2-4.
4P	Prime power operation.
9	Crank mode selection (open: cyclic crank, ground: continuous crank). Connect TB2-9 to TB2-9A for continuous cranking; leave TB2-9 open cyclic cranking; see starting instructions in Section 2, Operation.
9A	Crank mode ground.

Figure 6-17 16-Light Controller TB2 Terminal Strip

Terminal on TB1 (TB1A) or TB3 (TB1B)	Purpose
1	Ground. Emergency stop relay (K4). Connect emergency stop across terminals TB1-1 and 1A. *
1A	Emergency stop relay (K4) coil; negative side. Connect emergency stop across terminals TB1-1 and 1A. *
2	Ground terminal.
12	Overcrank (OC) signal. †
26	Auxiliary (AUX) signal. †
32	Common fault/prealarm line 1. audiovisual alarm or common fault relay activated by OC, 12; AUX, 26; LWT, 35; HET, 36; LOP, 38; OS, 39; AHET, 40; ALOP, 41; and LF, 63 faults.
32A	Common fault/prealarm line 2. audiovisual alarm or common fault relay activated by AUX, 26; HET, 36; LOP, 38; OS, 39; and ES, 48 faults.
35	Low water temperature (LWT) signal.
36	High engine temperature (HET) signal. †
38	Low oil pressure (LOP) signal. †
39	Overspeed (OS) signal. †
40	Anticipatory high engine temperature (AHET) signal. †
41	Anticipatory low oil pressure (ALOP) signal. †
42A	Battery voltage (fuse #1 protected). Accessory power supply; Customer may also provide separate accessory power source.
48	Emergency stop (ES) signal. †
56	Air damper (AD) switch.
60	System ready signal. †
61	Battery charger fault. Connect battery charger alarm contact to activate fault lamp (active low) (if used).
62	Low battery volts. Connect battery charger alarm contact to activate fault lamp (active low) (if used).
63	Low fuel (LF) fault. Connect fuel level sensor to activate fault lamp (active low) (if used).
70C	Generator in cool down mode signal.
70R	Generator in running mode signal.
80	Not in auto signal. †

* Connect jumper across terminals 1 and 1A if emergency stop switch is not used.
† Use a remote annunciator and/or audiovisual alarm kit as an indicator with a dry contact kit connected to controller terminal strip TB1 (TB1A) and TB3 (TB1B).

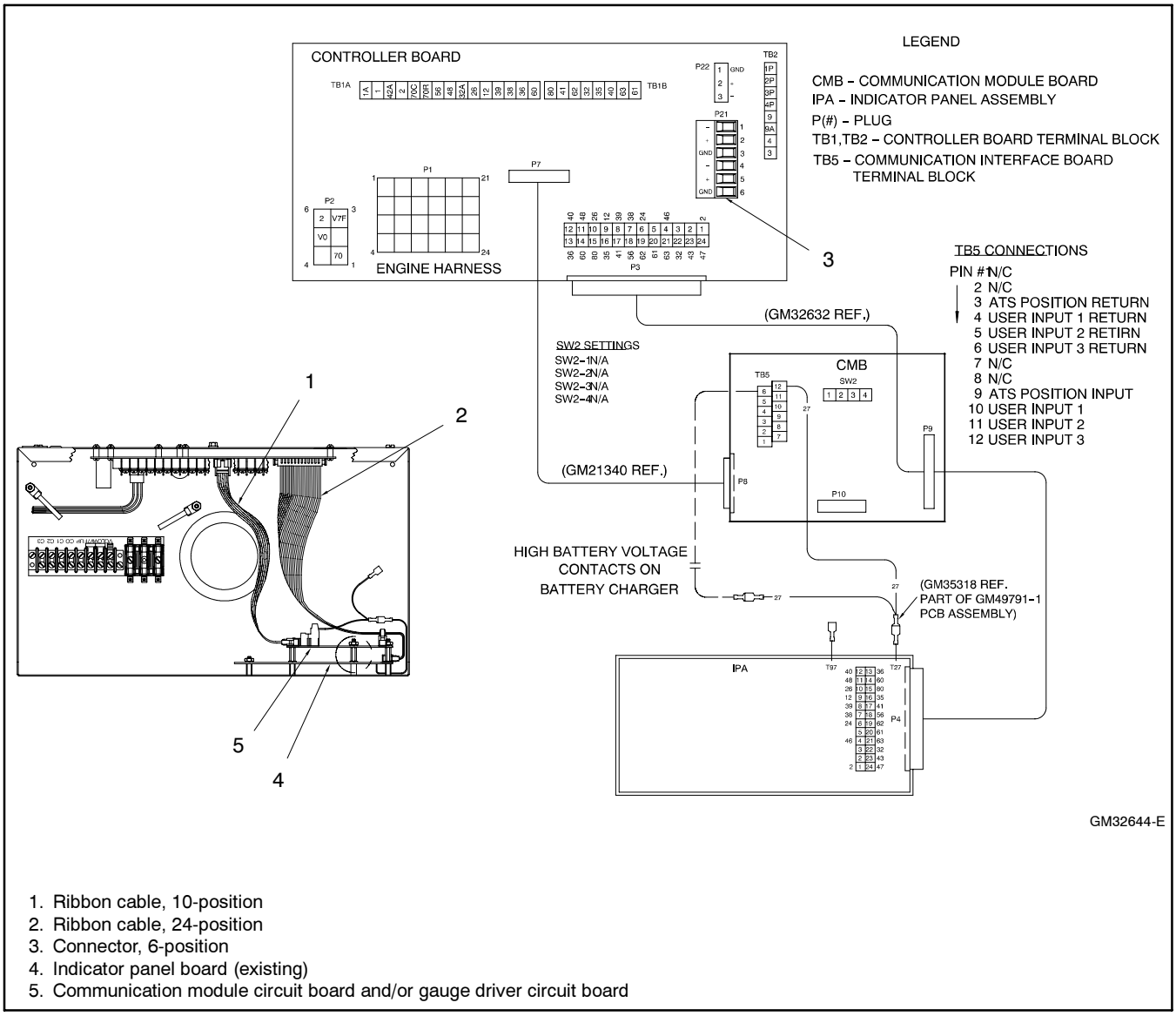
Figure 6-18 16-Light Controller TB1 (TB1A) and TB3 (TB1B) Terminal Strips

6.3 Communication Module Kit and Gauge Driver Circuit Board

When a remote serial annunciator (RSA) is connected to a Decision-Maker™ 3+ controller, a communication module circuit board is required. See Figure 6-19 for location and connection.

The communication module circuit board location may also be occupied by an interface circuit board with gauge drivers required for some models*. Do not confuse the function of these circuit boards.

* See the Introduction section and refer to Tech Tools, Engine Electronic Module (ECM) for the latest applications.

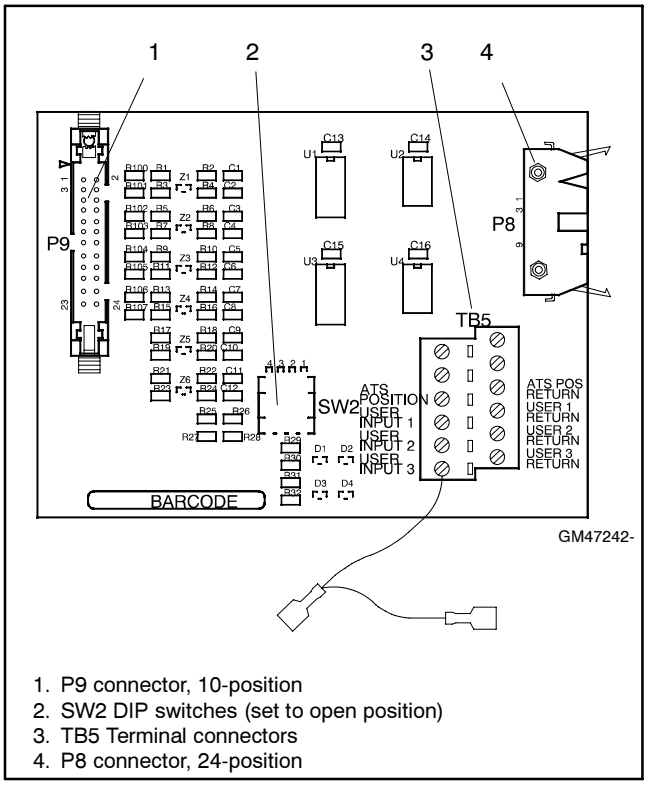


1. Ribbon cable, 10-position
2. Ribbon cable, 24-position
3. Connector, 6-position
4. Indicator panel board (existing)
5. Communication module circuit board and/or gauge driver circuit board

Figure 6-19 Communication Module Circuit Board Location and Connection

6.3.1 Communication Modules (Circuit Board) Versions

GM47242 Circuit Board. This is the communication module for all models except the 450/500REOZVB models and is superceded by GM49791-1. See Figure 6-20.



1. P9 connector, 10-position
2. SW2 DIP switches (set to open position)
3. TB5 Terminal connectors
4. P8 connector, 24-position

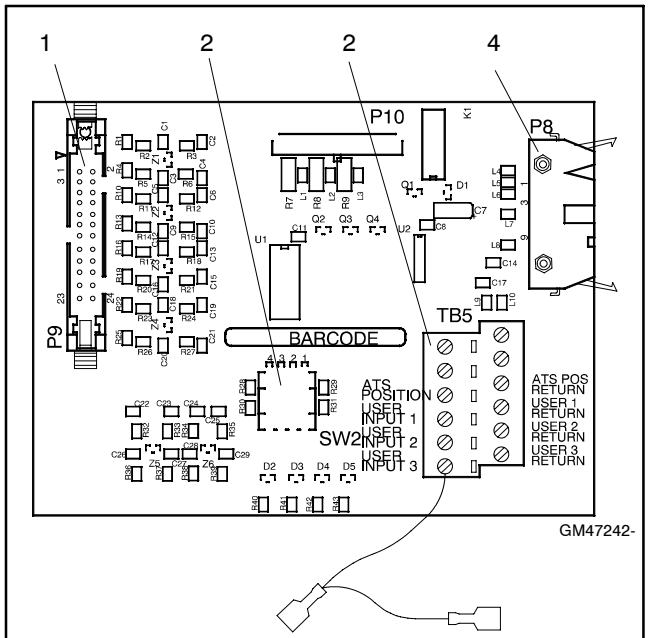
Figure 6-20 Communication Circuit Board GM47242

GM49791-1 Circuit Board. This is the communication module for all models and includes the gauge driver provision needed to drive the oil pressure and water temperature gauges for some models (requires application software version 1.23 or later). See Figure 6-21.

GM49791-2 Circuit Board. This is the interface circuit board with the gauge drivers required on the 450/500REOZVB models only. For communication purposes replace GM49791-2 with GM49791-1. GM49791-2 is mounted in the communication module location but does not provide the communication function. See Figure 6-22.

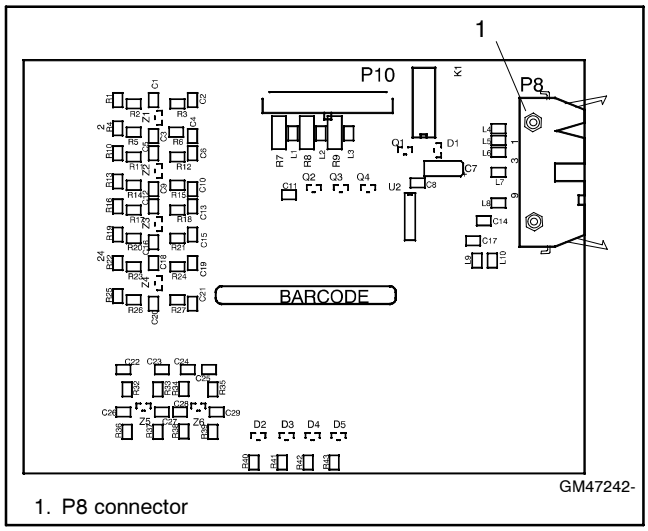
6.3.2 Circuit Boards Views

Figure 6-20, Figure 6-21, and Figure 6-22 show the differences between the communication circuit boards and the interface circuit board with gauge drivers. The SW2 DIP switches should be set to the open position unless the instructions supplied with the kit indicate another configuration.



1. P9 connector, 10-position
2. SW2 DIP switches (set to open position)
3. TB5 Terminal connectors
4. P8 connector, 24-position

Figure 6-21 Communication Circuit Board GM49791-1



1. P8 connector

Figure 6-22 Gauge Driver Circuit Board GM49791-2

Notes

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere
ABDC	after bottom dead center
AC	alternating current
A/D	analog to digital
ADC	advanced digital control; analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
Ah	amp-hour
AHWT	anticipatory high water temperature
AISI	American Iron and Steel Institute
ALOP	anticipatory low oil pressure
alt.	alternator
Al	aluminum
ANSI	American National Standards Institute (formerly American Standards Association, ASA)
AO	anticipatory only
APDC	Air Pollution Control District
API	American Petroleum Institute
approx.	approximate, approximately
AQMD	Air Quality Management District
AR	as required, as requested
AS	as supplied, as stated, as suggested
ASE	American Society of Engineers
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
auto.	automatic
aux.	auxiliary
avg.	average
AVR	automatic voltage regulator
AWG	American Wire Gauge
AWM	appliance wiring material
bat.	battery
BBDC	before bottom dead center
BC	battery charger, battery charging
BCA	battery charging alternator
BCI	Battery Council International
BDC	before dead center
BHP	brake horsepower
blk.	black (paint color), block (engine)
blk. htr.	block heater
BMEP	brake mean effective pressure
bps	bits per second
br.	brass
BTDC	before top dead center
Btu	British thermal unit
Btu/min.	British thermal units per minute
C	Celsius, centigrade
cal.	calorie
CAN	controller area network
CARB	California Air Resources Board
CB	circuit breaker
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
cert.	certificate, certification, certified
cfh	cubic feet per hour
cfm	cubic feet per minute
CG	center of gravity
CID	cubic inch displacement
CL	centerline
cm	centimeter
CMOS	complementary metal oxide substrate (semiconductor)
cogen.	cogeneration
com	communications (port)
coml	commercial
Coml/Rec	Commercial/Recreational
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cUL	Canadian Underwriter's Laboratories
CUL	Canadian Underwriter's Laboratories
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dB(A)	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
DFMEA	Design Failure Mode and Effects Analysis
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E, emer.	emergency (power source)
ECM	electronic control module, engine control module
EDI	electronic data interchange
EFR	emergency frequency relay
e.g.	for example (*exempli gratia)*
EG	electronic governor
EGSA	Electrical Generating Systems Association
EIA	Electronic Industries Association
EI/EO	end inlet/end outlet
EMI	electromagnetic interference
emiss.	emission
eng.	engine
EPA	Environmental Protection Agency
EPS	emergency power system
ER	emergency relay
ES	engineering special, engineered special
ESD	electrostatic discharge
est.	estimated
E-Stop	emergency stop
etc.	et cetera (and so forth)
exh.	exhaust
ext.	external
F	Fahrenheit, female
fglass.	fiberglass
FHM	flat head machine (screw)
fl. oz.	fluid ounce
flex.	flexible
freq.	frequency
FS	full scale
ft.	foot, feet
ft. lb.	foot pounds (torque)
ft./min.	feet per minute
ftp	file transfer protocol
g	gram
ga.	gauge (meters, wire size)
gal.	gallon
gen.	generator
genset	generator set
GFI	ground fault interrupter
GND, ⏚	ground
gov.	governor
gph	gallons per hour
gpm	gallons per minute
gr.	grade, gross
GRD	equipment ground
gr. wt.	gross weight
H x W x D	height by width by depth
HC	hex cap
HCHT	high cylinder head temperature
HD	heavy duty
HET	high exhaust temp., high engine temp.
hex	hexagon
Hg	mercury (element)
HH	hex head
HHC	hex head cap
HP	horsepower
hr.	hour
HS	heat shrink
hsg.	housing
HVAC	heating, ventilation, and air conditioning
HWT	high water temperature
Hz	hertz (cycles per second)
IC	integrated circuit
ID	inside diameter, identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMS	improved motor starting
in.	inch
in. H_2O	inches of water
in. Hg	inches of mercury
in. lb.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	iron pipe
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard

k	kilo (1000)
K	kelvin
kA	kiloampere
KB	kilobyte (2^{10} bytes)
KBus	Kohler communication protocol
kg	kilogram
kg/cm^2	kilograms per square centimeter
kgm	kilogram-meter
kg/m^3	kilograms per cubic meter
kHz	kilohertz
kJ	kilojoule
km	kilometer
kOhm, kΩ	kilo-ohm
kPa	kilopascal
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt ampere
kVAR	kilovolt ampere reactive
kW	kilowatt
kWh	kilowatt-hour
kWm	kilowatt mechanical
kWth	kilowatt-thermal
L	liter
LAN	local area network
L x W x H	length by width by height
lb.	pound, pounds
lbm/ft^3	pounds mass per cubic feet
LCB	line circuit breaker
LCD	liquid crystal display
ld. shd.	load shed
LED	light emitting diode
Lph	liters per hour
Lpm	liters per minute
LOP	low oil pressure
LP	liquefied petroleum
LPG	liquefied petroleum gas
LS	left side
L_{wa}	sound power level, A weighted
LWL	low water level
LWT	low water temperature
m	meter, milli (1/1000)
M	mega (10^6 when used with SI units), male
m^3	cubic meter
m^3/hr.	cubic meters per hour
m^3/min.	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCCB	molded-case circuit breaker
MCM	one thousand circular mils
meggar	megohmmeter
MHz	megahertz
mi.	mile
mil	one one-thousandth of an inch
min.	minimum, minute
misc.	miscellaneous
MJ	megajoule
mJ	millijoule
mm	millimeter
mOhm, mΩ	milliohm
MOhm, MΩ	megohm
MOV	metal oxide varistor
MPa	megapascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
ms	millisecond
m/sec.	meters per second
MTBF	mean time between failure
MTBO	mean time between overhauls
mtg.	mounting
MTU	Motoren-und Turbinen-Union
MW	megawatt
mW	milliwatt
μF	microfarad
N, norm.	normal (power source)
NA	not available, not applicable
nat. gas	natural gas
NBS	National Bureau of Standards
NC	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	newton meter
NO	normally open
no., nos.	number, numbers
NPS	National Pipe, Straight
NPSC	National Pipe, Straight-coupling
NPT	National Standard taper pipe thread per general use
NPTF	National Pipe, Taper-Fine
NR	not required, normal relay
ns	nanosecond
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OF	overfrequency
opt.	option, optional
OS	oversize, overspeed
OSHA	Occupational Safety and Health Administration
OV	overvoltage
oz.	ounce
p., pp.	page, pages
PC	personal computer
PCB	printed circuit board
pF	picofarad
PF	power factor
ph., ∅	phase
PHC	Phillips® head Crimptite® (screw)
PHH	Phillips® hex head (screw)
PHM	pan head machine (screw)
PLC	programmable logic control
PMG	permanent magnet generator
pot	potentiometer, potential
ppm	parts per million
PROM	programmable read-only memory
psi	pounds per square inch
psig	pounds per square inch gauge
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart, quarts
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
Res/Coml	Residential/Commercial
RFI	radio frequency interference
RH	round head
RHM	round head machine (screw)
rly.	relay
rms	root mean square
rnd.	round
ROM	read only memory
rot.	rotate, rotating
rpm	revolutions per minute
RS	right side
RTU	remote terminal unit
RTV	room temperature vulcanization
RW	read/write
SAE	Society of Automotive Engineers
scfm	standard cubic feet per minute
SCR	silicon controlled rectifier
s, sec.	second
SI	*Systeme international d'unites,* International System of Units
SI/EO	side in/end out
sil.	silencer
SN	serial number
SNMP	simple network management protocol
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec	specification
specs	specification(s)
sq.	square
sq. cm	square centimeter
sq. in.	square inch
SS	stainless steel
std.	standard
stl.	steel
tach.	tachometer
TD	time delay
TDC	top dead center
TDEC	time delay engine cooldown
TDEN	time delay emergency to normal
TDES	time delay engine start
TDNE	time delay normal to emergency
TDOE	time delay off to emergency
TDON	time delay off to normal
temp.	temperature
term.	terminal
THD	total harmonic distortion
TIF	telephone influence factor
TIR	total indicator reading
tol.	tolerance
turbo.	turbocharger
typ.	typical (same in multiple locations)
UF	underfrequency
UHF	ultrahigh frequency
UL	Underwriter's Laboratories, Inc.
UNC	unified coarse thread (was NC)
UNF	unified fine thread (was NF)
univ.	universal
US	undersize, underspeed
UV	ultraviolet, undervoltage
V	volt
VAC	volts alternating current
VAR	voltampere reactive
VDC	volts direct current
VFD	vacuum fluorescent display
VGA	video graphics adapter
VHF	very high frequency
W	watt
WCR	withstand and closing rating
w/	with
w/o	without
wt.	weight
xfmr	transformer

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Service

Industrial Generator Sets

Models:

20–300 kW

Alternators:

Fast-Response™ III (Wound Field Alternator)

SHOP DRAWING REVIEW

THIS DRAWING HAS BEEN REVIEWED FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT ONLY. SUCH REVIEW SHALL NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY FOR ERRORS OR OMISSIONS OR OF MEETING THE REQUIREMENTS OF THE CONTRACT DOCUMENTS. NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS OF DIMENSIONS OR DETAILS.

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	SEE COMMENTS
	AMEND & RESUBMIT
	REJECTED

Submission No. Rev 1
Project No. 038402-610
By MCL
Date May 27/09

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KOHLER® POWER SYSTEMS

TP-6349 6/07b

California Proposition 65

⚠ WARNING

Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Product Identification Information

Product identification numbers determine service parts. Record the product identification numbers in the spaces below immediately after unpacking the products so that the numbers are readily available for future reference. Record field-installed kit numbers after installing the kits.

Generator Set Identification Numbers

Record the product identification numbers from the generator set nameplate(s).

Model Designation _____

Specification Number _____

Serial Number _____

Accessory Number	Accessory Description

Controller Identification

Record the controller description from the generator set operation manual, spec sheet, or sales invoice.

Controller Description _____

Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer _____

Model Designation _____

Serial Number _____

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Notes

IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. SAVE THESE INSTRUCTIONS.

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

DANGER

Danger indicates the presence of a hazard that ***will cause severe personal injury, death***, or ***substantial property damage***.

WARNING

Warning indicates the presence of a hazard that ***can cause severe personal injury, death,*** or ***substantial property damage***.

CAUTION

Caution indicates the presence of a hazard that ***will*** or ***can cause minor personal injury*** or ***property damage***.

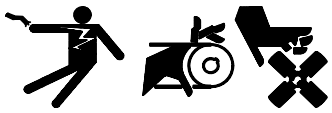
NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Battery

WARNING

Sulfuric acid in batteries.
Can cause severe injury or death.

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

WARNING

Explosion.
Can cause severe injury or death.
Relays in the battery charger cause arcs or sparks.

Locate the battery in a well-ventilated area. Isolate the battery charger from explosive fumes.

Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

Engine Backfire/Flash Fire

⚠ WARNING

Fire.
Can cause severe injury or death.

Do not smoke or permit flames or sparks near fuels or the fuel system.

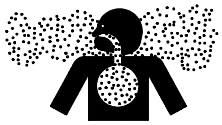
Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or carburetor.

Servicing the air cleaner. A sudden backfire can cause severe injury or death. Do not operate the generator set with the air cleaner removed.

Combustible materials. A fire can cause severe injury or death. Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

Exhaust System

⚠ WARNING



Carbon monoxide.
Can cause severe nausea, fainting, or death.

The exhaust system must be leakproof and routinely inspected.

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate the generator set where exhaust gas could accumulate and seep back inside a potentially occupied building.

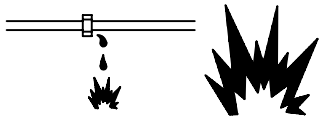
Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

Fuel System

⚠ WARNING



Explosive fuel vapors.
Can cause severe injury or death.

Use extreme care when handling, storing, and using fuels.

The fuel system. Explosive fuel vapors can cause severe injury or death. Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

Explosive fuel vapors can cause severe injury or death. Take additional precautions when using the following fuels:

Gasoline—Store gasoline only in approved red containers clearly marked GASOLINE.

Propane (LP)—Adequate ventilation is mandatory. Because propane is heavier than air, install propane gas detectors low in a room. Inspect the detectors per the manufacturer's instructions.

Natural Gas—Adequate ventilation is mandatory. Because natural gas rises, install natural gas detectors high in a room. Inspect the detectors per the manufacturer's instructions.

Fuel tanks. Explosive fuel vapors can cause severe injury or death. Gasoline and other volatile fuels stored in day tanks or subbase fuel tanks can cause an explosion. Store only diesel fuel in tanks.

Draining the fuel system. Explosive fuel vapors can cause severe injury or death. Spilled fuel can cause an explosion. Use a container to catch fuel when draining the fuel system. Wipe up spilled fuel after draining the system.

Gas fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LP vapor gas or natural gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to 6–8 ounces per square inch (10–14 inches water column). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

LP liquid withdrawal fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LP liquid withdrawal gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to at least 90 psi (621 kPa). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

Hazardous Noise

⚠ CAUTION

Hazardous noise.
Can cause hearing loss.

Never operate the generator set without a muffler or with a faulty exhaust system.

Engine noise. Hazardous noise can cause hearing loss. Generator sets not equipped with sound enclosures can produce noise levels greater than 105 dBA. Prolonged exposure to noise levels greater than 85 dBA can cause permanent hearing loss. Wear hearing protection when near an operating generator set.

Hazardous Voltage/ Electrical Shock

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ WARNING

Hazardous voltage. Moving rotor.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

⚠ WARNING

Hazardous voltage.
Backfeed to the utility system can cause property damage, severe injury, or death.

If the generator set is used for standby power, install an automatic transfer switch to prevent inadvertent interconnection of standby and normal sources of supply.

⚠ CAUTION

Welding the generator set.
Can cause severe electrical equipment damage.

Never weld components of the generator set without first disconnecting the battery, controller wiring harness, and engine electronic control module (ECM).

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

High voltage test. Hazardous voltage can cause severe injury or death. Follow the instructions of the test equipment manufacturer when performing high-voltage tests on the rotor or stator. An improper test procedure can damage equipment or lead to generator set failure.

Welding on the generator set. Can cause severe electrical equipment damage. Before welding on the generator set perform the following steps: (1) Remove the battery cables, negative (–) lead first. (2) Disconnect all engine electronic control module (ECM) connectors. (3) Disconnect all generator set controller and voltage regulator circuit board connectors. (4) Disconnect the engine battery-charging alternator connections. (5) Attach the weld ground connection close to the weld location.

Installing the battery charger. Hazardous voltage can cause severe injury or death. An ungrounded battery charger may cause electrical shock. Connect the battery charger enclosure to the ground of a permanent wiring system. As an alternative, install an equipment grounding conductor with circuit conductors and connect it to the equipment grounding terminal or the lead on the battery charger. Install the battery charger as prescribed in the equipment manual. Install the battery charger in compliance with local codes and ordinances.

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Engine block heater. Hazardous voltage can cause severe injury or death. The engine block heater can cause electrical shock. Remove the engine block heater plug from the electrical outlet before working on the block heater electrical connections.

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Install a transfer switch in standby power installations to prevent the connection of standby and other sources of power. Electrical backfeed into a utility electrical system can cause severe injury or death to utility personnel working on power lines.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Heavy Equipment

⚠ WARNING

Unbalanced weight.
Improper lifting can cause severe injury or death and equipment damage.

Do not use lifting eyes.
Lift the generator set using lifting bars inserted through the lifting holes on the skid.

Hot Parts

⚠ WARNING

Hot coolant and steam.
Can cause severe injury or death.

Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.

⚠ WARNING

Hot engine and exhaust system.
Can cause severe injury or death.

Do not work on the generator set until it cools.

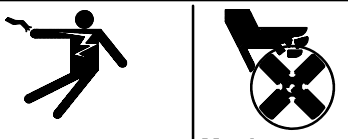
Servicing the alternator. Hot parts can cause severe injury or death. Avoid touching the alternator field or exciter armature. When shorted, the alternator field and exciter armature become hot enough to cause severe burns.

Checking the coolant level. Hot coolant can cause severe injury or death. Allow the engine to cool. Release pressure from the cooling system before removing the pressure cap. To release pressure, cover the pressure cap with a thick cloth and then slowly turn the cap counterclockwise to the first stop. Remove the cap after pressure has been completely released and the engine has cooled. Check the coolant level at the tank if the generator set has a coolant recovery tank.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

Moving Parts

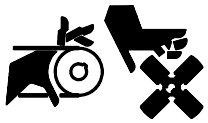
⚠ WARNING



Hazardous voltage. Moving rotor.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

⚠ WARNING



Rotating parts.
Can cause severe injury or death.

Operate the generator set only when all guards, screens, and covers are in place.

⚠ WARNING

Airborne particles.
Can cause severe injury or blindness.

Wear protective goggles and clothing when using power tools, hand tools, or compressed air.

Tightening the hardware. Flying projectiles can cause severe injury or death. Loose hardware can cause the hardware or pulley to release from the generator set engine and can cause personal injury. Retorque all crankshaft and rotor hardware after servicing. Do not loosen the crankshaft hardware or rotor thrubolt when making adjustments or servicing the generator set. Rotate the crankshaft manually in a clockwise direction only. Turning the crankshaft bolt or rotor thrubolt counterclockwise can loosen the hardware.

Servicing the generator set when it is operating. Exposed moving parts can cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

Notice

NOTICE

This generator set has been rewired from its nameplate voltage to

246242

NOTICE

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/dealer.

NOTICE

Hardware damage. The engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

NOTICE

When replacing hardware, do not substitute with inferior grade hardware. Screws and nuts are available in different hardness ratings. To indicate hardness, American Standard hardware uses a series of markings, and metric hardware uses a numeric system. Check the markings on the bolt heads and nuts for identification.

NOTICE

Canadian installations only. For standby service connect the output of the generator set to a suitably rated transfer switch in accordance with Canadian Electrical Code, Part 1.

Notes

This manual provides troubleshooting and repair instructions for the generator set models listed on the front cover using wound field alternators.

Wiring diagram manuals are available separately.

Refer to the generator set controller operation manual for operating instructions. Refer to the engine operation manual for generator set engine scheduled maintenance information. Refer to the engine service manual for generator set engine repair and overhaul information.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with the equipment for future reference.

The equipment service requirements are very important to safe and efficient operation. Inspect the parts often and perform required service at the prescribed intervals. Maintenance work must be performed by appropriately skilled and suitably trained maintenance personnel familiar with generator set operation and service.

List of Related Materials

Separate literature contains voltage regulator setup information not provided in this manual when the generator set has a 550 controller. Figure 1 lists the available literature part numbers.

Manual Description	Literature Part No.
Voltage Reguator Spec Sheet	G6-58
550 Controller Operation Manual	TP-6200

Figure 1 Related Literature

Service Assistance

For professional advice on generator set power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Consult the Yellow Pages under the heading Generators—Electric.
- Visit the Kohler Power Systems website at KohlerPower.com.
- Look at the labels and stickers on your Kohler product or review the appropriate literature or documents included with the product.
- Call toll free in the US and Canada 1-800-544-2444.
- Outside the US and Canada, call the nearest regional office.

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Fax: (86) 21 6288 0550

India, Bangladesh, Sri Lanka
India Regional Office
Bangalore, India
Phone: (91) 80 3366208
. (91) 80 3366231
Fax: (91) 80 3315972

Japan, Korea
North Asia Regional Office
Tokyo, Japan
Phone: (813) 3440-4515
Fax: (813) 3440-2727

Latin America
Latin America Regional Office
Lakeland, Florida, USA
Phone: (863) 619-7568
Fax: (863) 701-7131

1.1 Introduction

The specification sheets for each generator set provide specific alternator and engine information. Refer to the respective specification sheet for data not supplied in this manual. Consult the generator set operation manual, installation manual, engine operation manual, and engine service manual for additional specifications.

A wound field alternator is identified with a W as the last digit. Example: Gen. Model 4S11W.

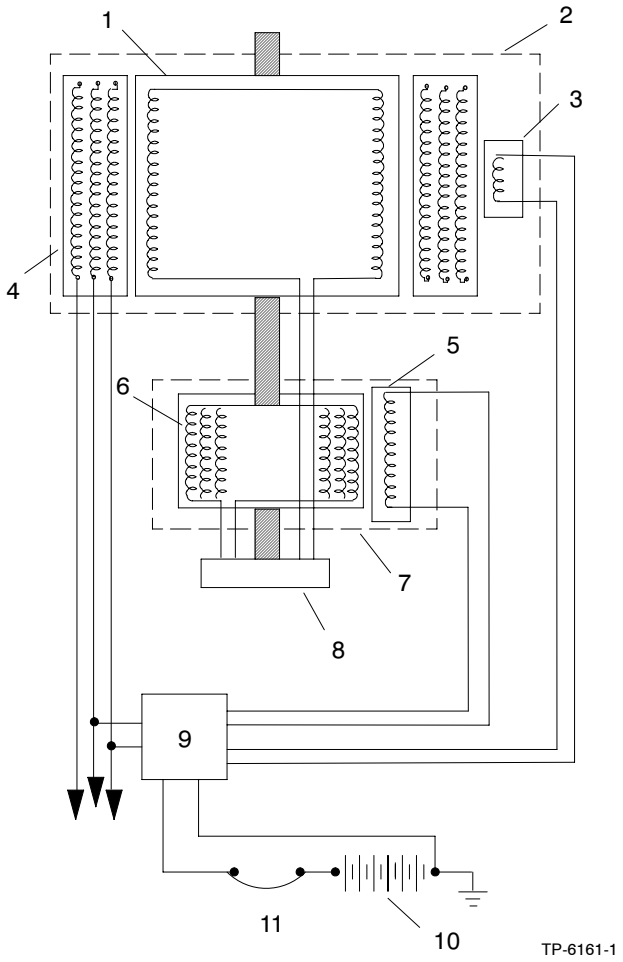
1.2 Wound Field Alternator Concept

The alternator is a 4-pole, rotating-field unit with a brushless, wound field (WF) excitation system. The generator set excitation system uses a wound exciter field and a three-phase exciter armature. The rotating rectifier assembly (RRA) is rated for over five times full load voltage and three times full load current with added surge protection. See Figure 1-1.

The ±0.25% average voltage regulator is powered by a stator auxiliary winding providing an independent power source for the exciter field. In addition, a rare earth permanent magnet is embedded in the exciter field for positive voltage buildup during startup. The voltage regulator has volt/Hz, stability, and voltage adjustments.

WF alternator sets offer the following advantages:

- Very good recovery characteristics because the auxiliary power for the voltage regulator comes from an independent stator winding that actually boosts the alternator's output during heavy loads.
- The inherent ability to support short-circuit current allowing system coordination for tripping downstream branch circuit breakers.
- For the duration of a short circuit in the load circuit(s), the output voltage drops and the amperage momentarily rises to 600%–1000% of the generator set's rated current.
- The voltage regulator requires low power and has tight average voltage regulation.
- The safeguard circuit breaker kit collapses the generator set's main field during a sustained heavy overload or short circuit.



1. Rotor main field
2. Main alternator
3. Stator auxiliary winding
4. Stator main windings
5. Exciter field winding
6. Exciter armature
7. Exciter alternator
8. Rotating rectifier assembly (RRA) and surge suppressor (varistor)
9. Voltage regulator
10. Engine starting battery
11. Safeguard circuit breaker (optional)

Figure 1-1 WF Alternator

1.3 Specifications, Resistance Values

Alternator Model	Alternator Leads	Nominal kW	Stator Main Winding, milliohm	Stator Aux. Winding, ohms	Rotor Main Field, ohms	Exciter Field Winding, ohms	Exciter Armature, ohms
4P4W	12 (Three Phase)	25	134	2.3	1.99	12.1	0.8
4P5W		30	101	2.1	2.25		
4P5BW		35	97	2.3	2.28		
4P7W		40	68	1.8	2.61		
4P7BW		45	69	1.9	2.67	17.3	0.4
4P8W		50	47.2	1.5	2.88		
4P10W		60	35.1	1.5	2.01		
4S7W		80	39.3	2.5	1.79		
4S9W		100	24.4	1.9	2.08		
4S11W		125	19.1	1.4	1.49		
4S13W		150	14.4	1.2	1.76		
4S15W		170	10.5	1.0	2.14		
4UA7W		180	15.5	1.9	1.56	10.8 *	0.3
4UA9W		230	9.7	1.2	1.83		
4UA10W		275	8.1	1.5	1.94		
4UA13W		300	5.5	1.0	2.54		
4P4W	6 (600 V)	25	218	2.3	1.99	12.1	0.8
4P5W		30	149	2.1	2.25		
4P5BW		35	152	2.3	2.28		
4P7W		40	116	1.8	2.61		
4P7BW		45	118	1.9	2.67	17.3	0.4
4P8W		50	88	1.5	2.88		
4P10W		60	55	1.5	2.01		
4S7W		80	61.5	2.5	1.79		
4S9W		100	45.4	1.9	2.08		
4S11W		125	36.6	1.4	1.49		
4S13W		150	30.8	1.2	1.76		
4S15W		170	15.9	1.0	2.14		
4UA7W		180	28.3	1.9	1.56	10.8 *	0.3
4UA9W		230	17.6	1.2	1.83		
4UA10W		275	18.8	1.5	1.94		
4UA13W		300	12.1	1.0	2.28		
4Q4W	4 (Single Phase)	30	50.5	2.4	1.99	12.1	0.8
4Q5W		35	34.7	1.9	2.25		
4Q7W		40	25.8	1.7	2.61		
4Q8W		45	23.6	1.6	2.88	17.3	0.4
4Q10W		55	17.5	1.3	2.01		
4V7W		75	16.3	1.4	1.79		
4V9W		95	10.6	1.1	2.08		
4V11W		110	6.7	1.1	1.49		

All resistance values are at 25°C (77°F) with ±12% tolerance.

* Early alternators with part numbers GM33000-xx have resistance values of 17.2 ohms.

1.4 Specifications, Electrical Values

Use the values shown in Figure 1-2 and Figure 1-3 during alternator testing.

Alternator Model	Hot Exciter Field No Load Readings at Rated Voltage	
	Volts	Amps
4P4W	7.4	0.6
4P5W	8.0	0.7
4P5BW	7.6	0.6
4P7W	9.4	0.8
4P7BW	9.0	0.7
4P8W	10.7	0.9
4P10W	9.6	0.8
4S7W	7.8	0.5
4S9W	9.3	0.5
4S11W	8.6	0.5
4S13W	9.7	0.6
4S15W	15.0	0.9
4UA7W	7.8	0.7
4UA9W	7.8	0.7
4UA10W	8.5	0.8
4UA13W	10.2	0.8
All values are at 25°C (77°F)		

Figure 1-2 Exciter Field Voltage/Current Values

Component	Value
Stator output voltages with separately excited alternator using a 12-volt battery	
Stator main windings, volts	>150 Volts
Stator auxiliary winding, volts	>300 Volts
All values are at 25°C (77°F)	

Figure 1-3 Stator Output Voltages

1.5 Specifications, Torque Values

Use the torque values shown in Figure 1-4 during alternator assembly. For assembly torque values not shown use the guidelines in Appendix C, General Torque Specifications.

Component	Model, kW	Torque Value
Ground lug assembly nuts	20–60	10.8 Nm (8 ft. lb.)
	80–300	45 Nm (34 ft. lb.)
Drive discs to rotor shaft bolts	20–170	61 Nm (45 ft. lb.)
	180–300	115 Nm (85 ft. lb.)
Fan to rotor flange bolts	20–170	26.4 Nm (19.5 ft. lb.)
	180–300	35 Nm (28 ft. lb.)
End bracket to stator bolts	180–300	95 Nm (70 ft. lb.)
Stator to generator adapter bolts	180–300	95 Nm (70 ft. lb.)
Terminal block to stator bolts	180–300	9.5 Nm (7 ft. lb.)
Terminal block link nuts	180–300	45 Nm (34 ft. lb.)
End bracket grease fitting	180–300	9.5 Nm (7 ft. lb.)
End bracket grease vent screw	180–300	9.5 Nm (7 ft. lb.)
Rotating rectifier assembly Mounting bolts AC exciter armature nuts F1/F2 main field nuts	 20–300 20–300 20–300	 6.6 Nm (58 in. lb.) 1.8 Nm (16 in. lb.) 2.9 Nm (26 in. lb.)
Alternator adapter to flywheel housing bolt torque	20–300	See chart following
Drive discs to flywheel bolt torque	20–300	See chart following

Figure 1-4 Torque Values

1.6 Alternator Adapter to Flywheel Housing Torque Values

Model	Alternator	Engine	Hardware Type,	Torque, Nm (ft. lb.)	Hardware Sequence
20-40 kW	4P, 4Q	John Deere	3/8-16, grade 8 bolt	53 (39)	Bolt, hardened washer
30-60 kW		GM	3/8-16, grade 8 bolt	53 (39)	
50/60 kW		John Deere	3/8-16, grade 8 bolt	53 (39)	
			M10, grade 10.9 bolt		
60-125 kW	4S, 4V	GM	3/8-16 grade 8 bolt	53 (39)	
60-180 kW		John Deere	3/8-16 grade 8 bolt	53 (39)	
			7/16-14, grade 8 bolt	60 (44)	
			M10, grade 10.9 bolt	65 (48)	
135/150 kW		DDC Series 50/60 Gas	7/16-14, grade 8 bolt	60 (44)	
150-275 kW	4UA	DDC Series 50/60 Gas	7/16-14, grade 8 bolt	85 (63)	
200 kW		DDC Series 40	3/8-16, grade 8 bolt	53 (39)	
200/230 kW		John Deere	3/8-16, grade 8 bolt	53 (39)	
			7/16-14, grade 8 bolt	85 (63)	
			M10, grade 10.9 bolt	65 (48)	
200-300 kW		Kohler Branded D200/D250/D300	7/16-14, grade 8 bolt	85 (63)	
			M10, grade 10.9 bolt	65 (48)	
230-300 kW		DDC Series 60 Diesel	7/16-14, grade 8 bolt	85 (63)	

1.7 Drive Discs to Flywheel Torque Values

Model	Alternator	Engine	Hardware Type,	Torque, Nm (ft. lb.)	Hardware Sequence
20-40 kW	4P, 4Q	John Deere	3/8-16, grade 8 stud	53 (39)	Stud, spacer, hardened washer, grade 8 nut
30-60 kW 50/60 kW		GM John Deere	3/8-16, grade 8 stud	53 (39)	Stud, spacer, hardened washer, nut
60-125 kW 80-180 kW	4S, 4V	GM John Deere	3/8-16, grade 8 stud	53 (39)	
135/150 kW		DDC Series 50/60 Gas	1/2-13, grade 8 bolt	60 (44)	Bolt, hardened washer
150-275 kW	4UA	DDC Series 50/60 Gas	1/2-13, grade 8 bolt	130 (96)	
200 kW		DDC Series 40	3/8-16, grade 8 stud	53 (39)	Stud, spacer, hardened washer, grade 8 nut
200/230 kW		John Deere	1/2-13, grade 8 bolt	130 (96)	Bolt, hardened washer
200-300 kW		Kohler Branded D200/D250/D300	1/2-13, grade 8 bolt	130 (96)	
			M12, grade 10.9 bolt	122 (90)	
230-300 kW		DDC Series 60 Diesel	1/2-13, grade 8 bolt	130 (96)	

1.8 Terminal Block Reconnection Decal, 80–300 kW

The terminal block decal shown in Figure 1-5 and Figure 1-6 provide the voltage reconnection combinations and terminal block hardware torque values.

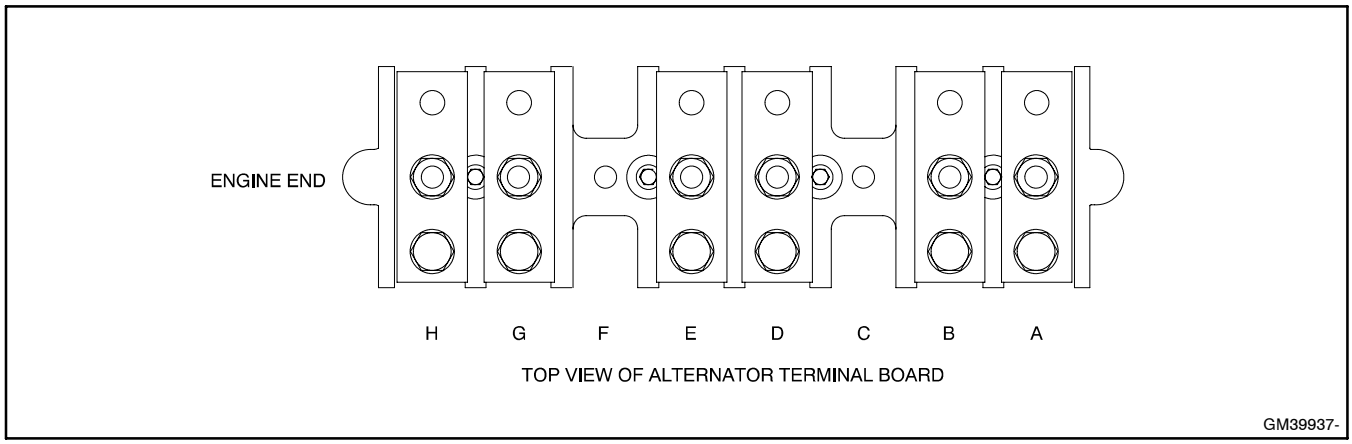
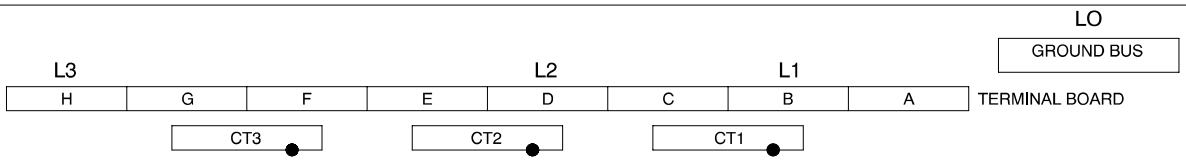


Figure 1-5 Load Connections

TERMINAL BOARD RECONNECTION DIAGRAM



TERMINAL BOARD LOCATION	12/24 LEAD STATOR CONNECTIONS								6 LEAD STATOR		4 LEAD STATOR	
	HIGH WYE 380V 416V 480V		LOW WYE 208V 240V		DELTA 120V/240V		DOGLEG 120V/240V		WYE 600V		SINGLE PHASE ONLY 120V/240V	
	CONN	BUS QTY	CONN	BUS QTY	CONN	BUS QTY	CONN	BUS QTY	CONN	BUS QTY	CONN	BUS QTY
A	4,7	1	OPEN	0	3,12	1	OPEN	0	OPEN	0	OPEN	0
B (L1)	1 (L1)	NOTE 1	1,7 (L1)	NOTE 2	6,7 (L1)	NOTE 1	1,7 (L1)	NOTE 1	1 (L1)	NOTE 1	1 (L1)	NOTE 1
C	OPEN	0	OPEN	0	OPEN	0	OPEN	0	OPEN	0	OPEN	0
D (L2)	2 (L2)	NOTE 1	2,8 (L2)	0	4,8 (L2)	NOTE 1	2,8 (L2)	NOTE 1	2 (L2)	NOTE 1	4 (L2)	NOTE 1
E	5,8	1	OPEN	NOTE 2	OPEN	0	OPEN	0	OPEN	0	OPEN	0
F	OPEN	0	OPEN	0	OPEN	0	OPEN	0	OPEN	0	OPEN	0
G	6,9	1	OPEN	0	2,11	1	OPEN	0	OPEN	0	OPEN	0
H (L3)	3 (L3)	NOTE 1	3,9 (L3)	NOTE 2	5,9 (L3)	NOTE 1	3,5,9,11	1	3 (L3)	NOTE 1	OPEN	0
NOTES: 1) USE 1 BUS FOR 4S7, 4V7, 4S9, 4V9, 4S11, 4V11, 4S13, 4S15, 4UA7, 4UA9, 4AU10. USE 2 BUS FOR 4UA13 AND 4UA16. 2) USE 2 BUS FOR 4S7, 4V7, 4S9, 4V9, 4S11, 4V11, 4S13, 4S15, 4UA7, 4UA9, 4AU10. USE 3 BUS FOR 4UA13 AND 4UA16.												
GROUND BUS	10,11,12		4,5,6,10,11,12		1,10		4,6,10,12		4,5,6		2,3	
CURRENT TRANSFORMERS												
CT1	1,7		1,7		6,7		1,7		1		1	
CT2	2,8		2,8		4,8		2,8		2		4	
CT3	3,9		3,9		5,9		OPEN		3		OPEN	
LINE CONNECTIONS												
L1	B		B		B		B		B		B	
L2	D		D		D		D		D		D	
L3	H		H		H				H			
L0	GROUND BUS		GROUND BUS		GROUND BUS		GROUND BUS		GROUND BUS		GROUND BUS	
NOTE: CURRENT TRANSFORMER DOT OR "HI" TOWARD GENERATOR TORQUE TERMINAL BOARD HARDWARE TO 45 Nm [34 FT–LBS]												

GM39792-B

Figure 1-6 Reconnection Decal

Notes

Section 2 Troubleshooting

This section contains generator set troubleshooting, diagnostic, and repair information.

Use the chart on the following pages to diagnose and correct common problems. First check for simple causes such as a dead engine starting battery or an open circuit breaker. The chart includes a list of common problems, possible causes of the problem, recommended corrective actions, and references to detailed information or repair procedures.

Maintain a record of repairs and adjustments performed on the equipment. If the procedures in this manual do not explain how to correct the problem, contact an authorized distributor/dealer. Use the record to help describe the problem and repairs or adjustments made to the equipment.

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Controller												
x	x									Controller circuit board(s) inoperative	Replace the controller circuit board.	—
				x						Controller fault	Troubleshoot the controller.†	Generator set O/M
x	x			x						Controller fuse blown	Replace the blown controller fuse. If the fuse blows again, troubleshoot the controller.†	W/D
x										Controller master switch inoperative	Replace the controller master switch.	—
x										Controller master switch in the OFF/RESET position	Move the controller master switch to the RUN or AUTO position.	Generator set O/M
x										Engine start circuit open	Move the controller master switch to the RUN position to test the generator set. Troubleshoot the auto start circuit and time delays.	Generator set O/M, W/D, ATS O/M, S/M
Cooling System												
						x		x		Air openings clogged	Clean the air openings.	—
						x				Coolant level low	Restore the coolant to normal operating level.	Generator set O/M
						x				Cooling water pump inoperative	Tighten or replace the belt. Replace the water pump.	Eng. O/M or S/M
				x						High temperature shutdown	Allow the engine to cool down. Then troubleshoot the cooling system.	Generator set O/M, Eng. O/M
				x						Low coolant level shutdown, if equipped	Restore the coolant to normal operating level.	Generator set O/M
						x				Thermostat inoperative	Replace the thermostat.	Eng. S/M

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram Manual

† Have an authorized service distributor/dealer perform this service.

‡ If the unit has a 550 controller, refer to the 550 controller operation manual for voltage regulator settings. Go to Menu 20, Factory Setup and verify that the application software (code version) is correct for the generator set model and alternator voltage.

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Electrical System (DC circuits)												
x	x									Battery connections loose, corroded, or incorrect	Verify that the battery connections are correct, clean, and tight.	Generator set O/M
x	x									Battery weak or dead	Recharge or replace the battery. The spec sheet provides recommended battery CCA rating.	Generator set O/M, S/S
x	x									Starter/starter solenoid inoperative	Replace the starter or starter solenoid.	Eng. S/M
x				x						Engine harness connector(s) not locked tight	Disconnect the engine harness connector(s) then reconnect it to the controller.	W/D
				x						High water temperature switch inoperative	Replace the inoperative switch.	Engine S/M or W/D
				x						Fault shutdown	Reset the fault switches and troubleshoot the controller.	Generator set O/M
				x						High exhaust temperature switch inoperative	Replace the inoperative switch.	Engine S/M or W/D
Engine												
	x	x			x			x		Air cleaner clogged	Clean or replace the filter element.	Eng. O/M
	x	x				x		x	x	Compression weak	Check the compression.†	Eng. S/M
			x		x	x		x	x	Engine overload	Reduce the electrical load. See the generator set spec sheet for wattage specifications.	S/S
									x	Exhaust system leak	Inspect the exhaust system. Replace the inoperative exhaust system components.†	I/M
									x	Exhaust system not securely installed	Inspect the exhaust system. Tighten the loose exhaust system components.†	I/M
		x	x		x			x		Governor inoperative	Adjust the governor.†	Governor literature
					x				x	Valve clearance incorrect	Adjust the valves.†	Eng. S/M
									x	Vibration excessive	Tighten all loose hardware.	—
	x	x			x					Ignition system inoperative (gas/gasoline only)	Check the ignition system (spark plugs, spark plug wires, etc.).	Eng. O/M

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† Have an authorized service distributor/dealer perform this service.

‡ If the unit has a 550 controller, refer to the 550 controller operation manual for voltage regulator settings. Go to Menu 20, Factory Setup and verify that the application software (code version) is correct for the generator set model and alternator voltage.

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Fuel System												
	x	x			x					Air in fuel system (diesel only)	Bleed the diesel fuel system.	Eng. O/M
	x	x								Ether canister empty or system inoperative, if equipped (diesel only)	Replace or repair the ether starting system.	Eng. O/M
	x			x						Fuel tank empty or fuel valve shut off	Add fuel and move the fuel valve to the ON position.	—
	x				x			x		Fuel feed or injection pump inoperative (diesel only)	Rebuild or replace the injection pump.†	Eng. S/M
	x	x			x					Fuel or fuel injectors dirty or faulty (diesel only)	Clean, test, and/or replace the inoperative fuel injector.†	Eng. S/M
	x	x		x	x					Fuel filter restriction	Clean or replace the fuel filter.	Eng. O/M
	x									Fuel solenoid inoperative	Troubleshoot the fuel solenoid.†	Eng. S/M
	x				x					Fuel pressure insufficient (gas only)	Check the fuel supply and valves.†	S/S, Gen. O/M
	x	x			x			x		Fuel injection timing out of adjustment (diesel only)	Adjust the fuel injection timing.†	Eng. S/M
Alternator												
			x							AC output circuit breaker open	Reset the breaker and check for AC voltage at the generator side of the circuit breaker.	—
x										Transfer switch test switch in the OFF position	Move the transfer switch test switch to the AUTO position.	ATS O/M
			x							Transfer switch fails to transfer load	Move the ATS test switch to the AUTO position. Troubleshoot the transfer circuit and time delays.	ATS O/M, S/M
			x							Wiring, terminals, or pin in the exciter field open	Check for continuity.	Section 3, W/D
			x							Main field (rotor) inoperative (open or grounded)	Test and/or replace the rotor.†	Section 3
			x							Stator inoperative (open or grounded)	Test and/or replace the stator.†	Section 3
									x	Vibration excessive	Tighten loose components.†	—
			x	x						Voltage regulator digital settings incorrect (digital controller only)	Adjust the voltage regulator.	Section 3 ‡
			x	x						Voltage regulator inoperative	Replace the voltage regulator fuse, If the fuse blows again, troubleshoot the voltage regulator.	Section 3 ‡
			x	x						Voltage regulator out of adjustment	Adjust the voltage regulator.	Section 3 ‡

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† Have an authorized service distributor/dealer perform this service.

‡ If the unit has a 550 controller, refer to the 550 controller operation manual for voltage regulator settings. Go to Menu 20, Factory Setup and verify that the application software (code version) is correct for the generator set model and alternator voltage.

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Lube System												
	x	x					x		x	Crankcase oil type incorrect for ambient temperature	Change the oil. Use oil with a viscosity suitable for the operating climate.	Eng. O/M
						x	x		x	Oil level low	Restore the oil level. Inspect the generator set for oil leaks.	Eng. O/M
				x						Low oil pressure shutdown	Check the oil level.	Eng. O/M

***** Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram Manual

† Have an authorized service distributor/dealer perform this service.

‡ If the unit has a 550 controller, refer to the 550 controller operation manual for voltage regulator settings. Go to Menu 20, Factory Setup and verify that the application software (code version) is correct for the generator set model and alternator voltage.

Notes

3.1 General

Before beginning the troubleshooting procedures, read all the safety precautions at the beginning of this manual. The following tests include additional safety precautions; OBSERVE THESE PRECAUTIONS!

⚠ WARNING

Hazardous voltage. Moving rotor. Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

3.2 General Troubleshooting

To determine the cause of no- or low-AC output , refer to the following steps and the troubleshooting flow chart (Figure 3-1).

1. Check the condition of the voltage regulator 10-amp fuse located in the junction box.
2. If the fuse is good, separately excite the alternator (see Section 3.3). The separate excitation test duplicates the role of the voltage regulator in providing the excitation current to the rotor.
3. If voltage regulator failure is suspected, go to Section 3.4, Wound Field Voltage Regulators.

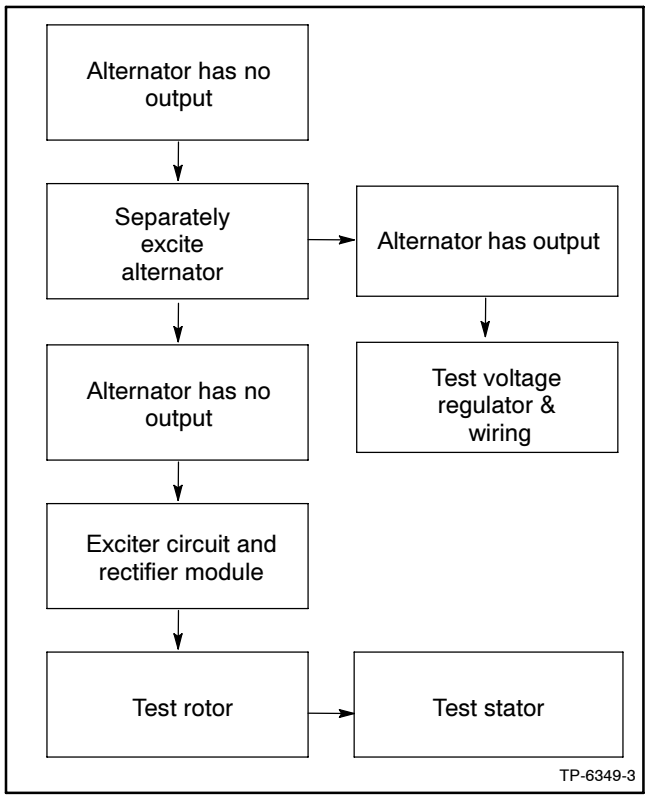


Figure 3-1 General Troubleshooting

3.3 Separate Excitation

By separately exciting the alternator to determine the presence of a faulty voltage regulator, it is possible to determine if a running fault exists in the rotor and/or stator. A alternator component that appears good while static (stationary) may exhibit a running open or short circuit while dynamic (moving). Short circuits can be caused by centrifugal forces acting on the windings during rotation or insulation breakdown as temperatures increase.

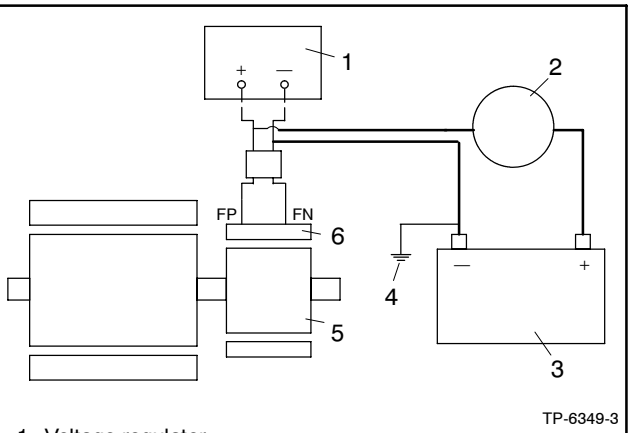
1. Disconnect all of the leads from the voltage regulator.
2. Disconnect the FP/FN connector.
3. Disconnect the exciter field winding leads. Connect an ohmmeter to the exciter field winding and measure the resistance.

4. Connect separate excitation circuit as shown in Figure 3-2. Connect a DC ammeter in series with FP. Note and record the ammeter reading.

   The approximate ammeter reading should be battery voltage divided by the specified exciter field winding resistances (cold). See Section 1, Specifications, for the values.

   Example:

   $$\frac{\text{12 Volts (Battery Voltage)}}{\text{12.1 Ohms Exciter Field Winding Resistance}} = \text{0.99 amps Exciter Field Winding Current}$$



1. Voltage regulator
2. DC ammeter
3. Battery
4. Ground to alternator frame
5. Exciter armature
6. Exciter field winding

Figure 3-2 Separate Excitation Connections

5. Move the generator set master switch to the RUN position to start the generator set.

6. Check the ammeter values.

   Unstable ammeter reading. An increasing meter reading indicates a shorted exciter field. A decreasing meter reading to zero, or unstable reading, suggests a running open in the exciter.

   Stable ammeter reading. If the ammeter is stable, continue with the next step.

7. Use a voltmeter and check for AC output across the stator main windings and compare it to the values in Section 1, Specifications. If the stator main windings output varies considerably from those listed, a faulty stator, rotor, rotating rectifier assembly, or exciter armature is likely.

8. Place the generator set master switch to the OFF/RESET position to stop the generator set.

If the AC output is not within specifications, the voltage regulator is probably defective. If there is no alternator output during normal operation, but output is available when the generator set is separately excited, the voltage regulator is probably defective.

Note: See Section 1, Specifications, for the stator output voltages (with separately excited alternator). These specifications are based on a battery voltage of 12. Should the battery voltage vary (11–14 volts), the resulting stator output values will also vary.

3.4 Wound Field Voltage Regulators

3.4.1 Unstable Voltage Troubleshooting

Before replacing the voltage regulator, use the flowchart in Figure 3-3 to troubleshoot the generator set when unstable voltage is detected. The remaining parts of this section give additional and more detailed information about the individual checks/tests mentioned in the flowchart.

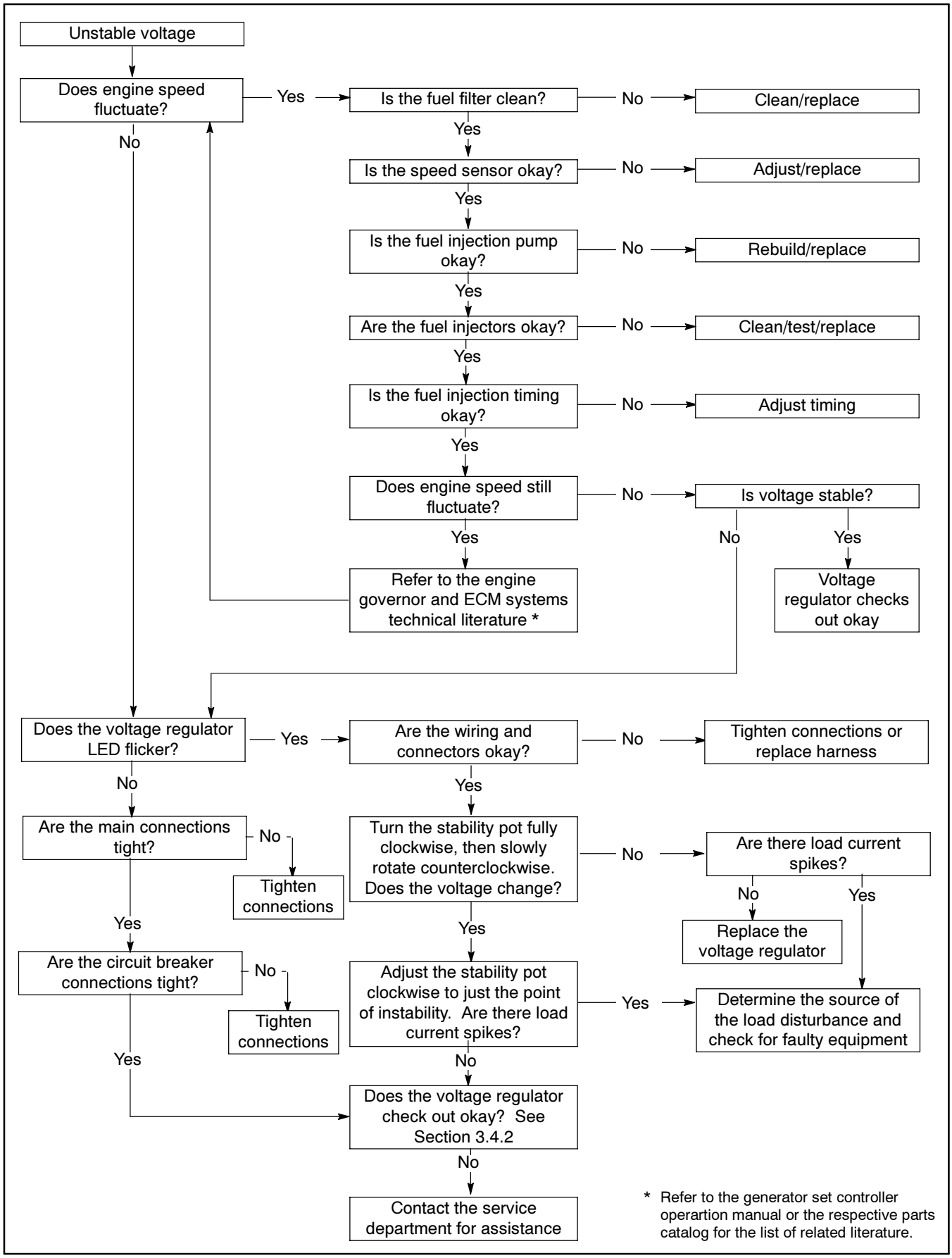
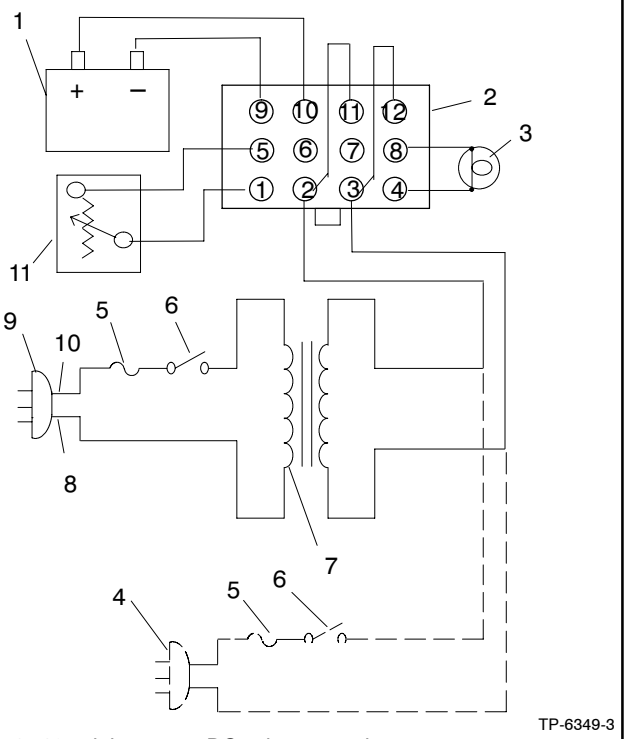


Figure 3-3 Troubleshooting Generator Set, Unstable Voltage

3.4.2 Voltage Regulator Test

The generator set is equipped with a wound field voltage regulator. See Figure 3-4.



1. 12 volt battery or DC voltage supply
2. Voltage regulator 12-pin plug (pin insertion end shown)
3. 250-volt, 100-watt lamp
4. 200–240 VAC (optional)
5. 1-amp fuse
6. Single-pole single-throw switch
7. 1:2 step-up transformer
8. White wire
9. 100–120 VAC
10. Black wire
11. Potentiometer (1 kOhm)

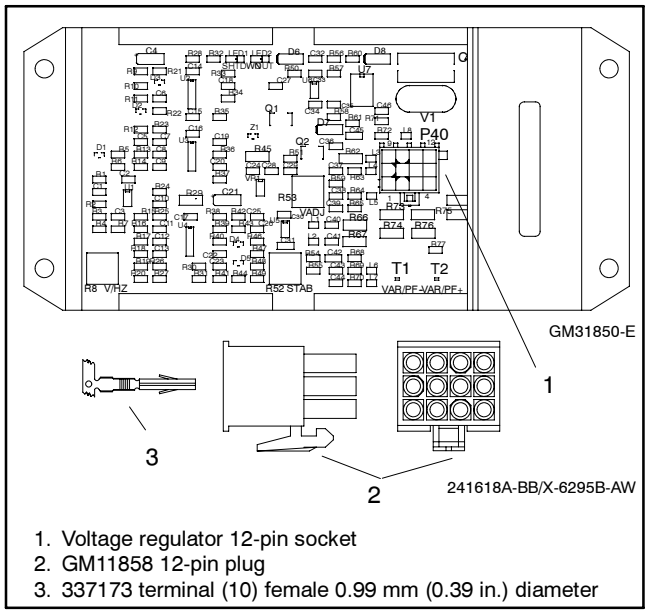
Figure 3-4 Voltage Regulator Test with User-Fabricated Adapter Harness

The voltage regulator monitors output voltage magnitude to control the current to the exciter field windings. The voltage regulator has an underfrequency unloading feature that is referred to as volts-per-Hz (V/Hz). To determine if the voltage regulator is functioning, reduce the engine speed (Hz), if possible, and watch for a corresponding drop in the AC voltage. The AC voltage should remain constant until the engine speed drops below 57.5 Hz on 60 Hz models or 47.5 Hz on 50 Hz models.

When the frequency drops below either 57.5 or 47.5 Hz, the AC voltage should decline. Perform the following test to check the voltage regulator output.

The following components will be needed to test the voltage regulator:

- 12 volt battery or DC power supply, isolated
- Step-up transformer, 1:2, 120 volts to 240 volts (1.0 amp min.)
- 1 kOhm 1/2 watt potentiometer
- Variable transformer, 0–140 volts (1.0 amp min.)
- Voltage regulator adapter harness (see Figure 3-5) make from:
  - (1) plug, part no. GM11858
  - (10) terminals, part no. 337137
  - (10) leads, 18 ga., 610 mm (24 in.) long



1. Voltage regulator 12-pin socket
2. GM11858 12-pin plug
3. 337173 terminal (10) female 0.99 mm (0.39 in.) diameter

Figure 3-5 Voltage Regulator Adapter Harness

- Lamp, 250-volt, 100-watt
- Fuse, 1-amp
- Switch, 1 single-pole single-throw (SPST) 1 amp (minimum)
- Plug, 120-volt AC (200–240 volt AC plug optional)
- Stranded copper wire, #18 AWG

⚠ WARNING

Hazardous voltage. Moving rotor. Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

High voltage test. Hazardous voltage can cause severe injury or death. Follow the instructions of the test equipment manufacturer when performing high-voltage tests on the rotor or stator. An improper test procedure can damage equipment or lead to generator set failure.

Voltage Regulator Test Procedure

1. Connect the components as shown in Figure 3-4. If a 200–240 volt power source is available, the step-up transformer is not required.

2. Turn 1 kOhm potentiometer fully counterclockwise. See Figure 3-4, item 11.

3. Plug the power cord into the outlet.

4. Turn the power supply on. The 100-watt lamp should be off. If 100-watt lamp is lit, replace the voltage regulator. It is acceptable for the lamp to briefly illuminate at powerup.

5. Slowly turn the 1 kOhm potentiometer clockwise. The 100-watt lamp should light. Replace the voltage regulator if the 100-watt lamp does not light.

3.4.3 Voltage Regulator Adjustment

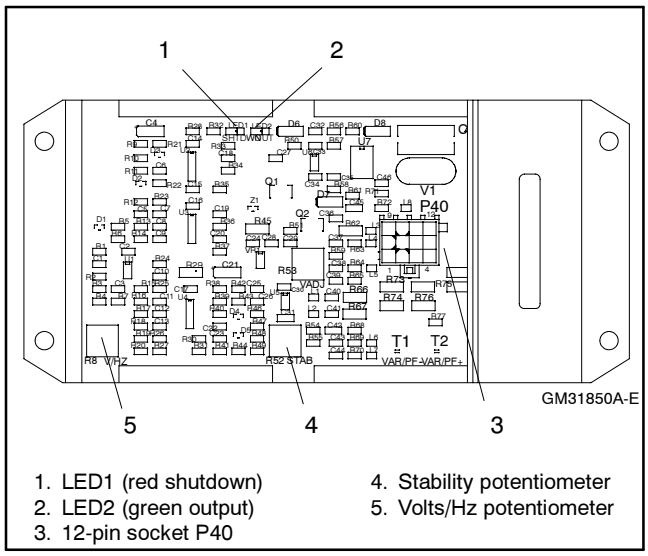
The voltage regulator is factory-set and, under normal circumstances, requires no further adjustment. However, if the voltage regulator has been replaced, or tampered with, or if voltage/frequency reconnection has been done, readjust the voltage regulator according to the following procedure. The voltage regulator components are identified and described in the following paragraphs. Figure 3-6 illustrates the voltage regulator features. Figure 3-7 identifies the voltage regulator connections to the P40 socket.

Note: Frequency reconnection. Refer to the respective generator set spec sheet to determine if engine frequency (speed) is fixed or field-convertible.

Stability Potentiometer. Potentiometer fine tunes the regulator circuitry to reduce light flicker.

Volts/Hz Potentiometer. Potentiometer adjustment determines the engine speed (Hz) at which the alternator output begins to drop.

Voltage Adjustment (remote only). Use the generator set controller voltage adjustment control to adjust the alternator output. See the respective generator set operation manual for further information.



1. LED1 (red shutdown)
2. LED2 (green output)
3. 12-pin socket P40
4. Stability potentiometer
5. Volts/Hz potentiometer

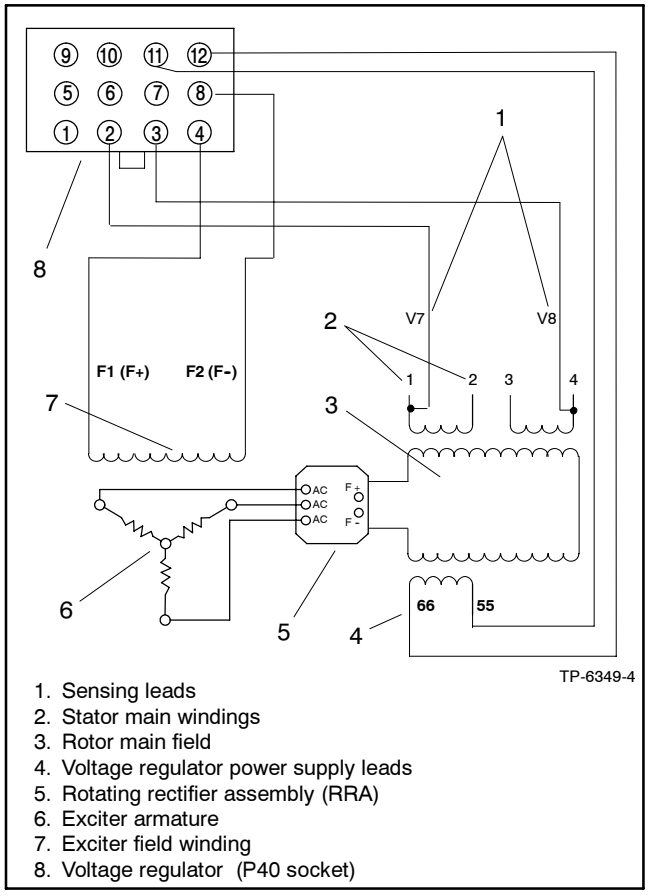
Figure 3-6 Voltage Regulator Features

Socket P40-	Lead	Description/Function
1	68	Remote voltage adjustment
2	V7	TB4-V7 sensing input
3	V8	TB4-V8 sensing input
4	FP	Exciter field output
5	67	Remote voltage adjustment
6	EOV	Overvoltage controller output signal
7	—	Not used
8	FN	Exciter field output
9	7N	TB11-7N (battery negative)
10	1B	Safeguard circuit breaker (battery positive)
11	55	Voltage regulator power supply
12	66	Voltage regulator power supply

Figure 3-7 Voltage Regulator P40 Connections

Voltage Regulator Adjustment Procedure

Figure 3-8 illustrates the wiring connections necessary for the voltage regulator adjustment procedure.



1. Sensing leads
2. Stator main windings
3. Rotor main field
4. Voltage regulator power supply leads
5. Rotating rectifier assembly (RRA)
6. Exciter armature
7. Exciter field winding
8. Voltage regulator (P40 socket)

Figure 3-8 Voltage Regulator Connection

1. Verify that the generator set master switch is in the OFF/RESET position.
2. Turn the Volts/Hz and the stability potentiometers fully counterclockwise. Connect the voltmeter to the AC circuit or an electrical outlet.
3. Move the generator set master switch to the RUN position.
4. Change the voltage adjustment control (located at the generator set controller) until the desired output voltage is achieved.
5. Rotate the stability potentiometer clockwise until light flicker minimizes.
6. Readjust the voltage adjustment control (located at the generator set controller) until the desired output voltage is achieved.
7. If the engine has a speed adjustment governor, adjust the engine speed to the specified cut-in frequency as measured on the frequency meter. The factory setting is 57.5–58 Hz for 60 Hz models and 47.5–48 Hz for 50 Hz models.

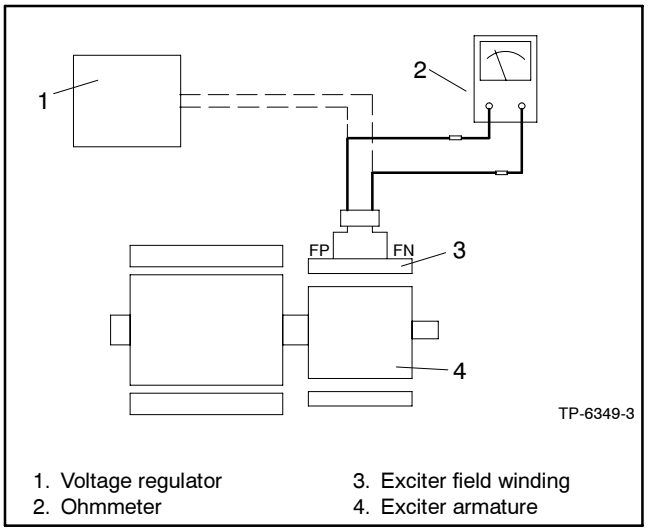
   Note: Some engines do not permit engine speed adjustment.
8. Rotate the volts/Hz potentiometer clockwise until the voltage level as measured on the voltmeter begins to drop. When the regulator is set to these specifications, the alternator will attempt to maintain normal output until the engine speed drops below the frequency set in step 7 as load is applied.
9. Readjust the engine speed to 1800 rpm for 60 Hz models or1500 rpm for 50 Hz models.
10. Readjust the voltage adjustment control (located at the generator set controller) until the desired output is achieved.
11. Readjust the stability potentiometer until light flicker minimizes.
12. Move the generator set master switch to the OFF/RESET position.

3.5 Exciter Field

Direct current from the battery magnetizes the exciter field winding. When the exciter armature rotates within the magnetized exciter field windings, an electrical current develops within the exciter armature. Test the exciter field winding according to the following procedure.

Exciter Field Test Procedure

1. Place the generator set master switch to the OFF/RESET position.
2. Disconnect the generator set engine starting battery, negative (–) lead first.
3. Disconnect the FP/FN leads.
4. Check the exciter field resistance by connecting an ohmmeter across exciter field FP and FN leads. See Figure 3-9. See Section 1, Specifications, for resistance reading for a cold exciter field winding.

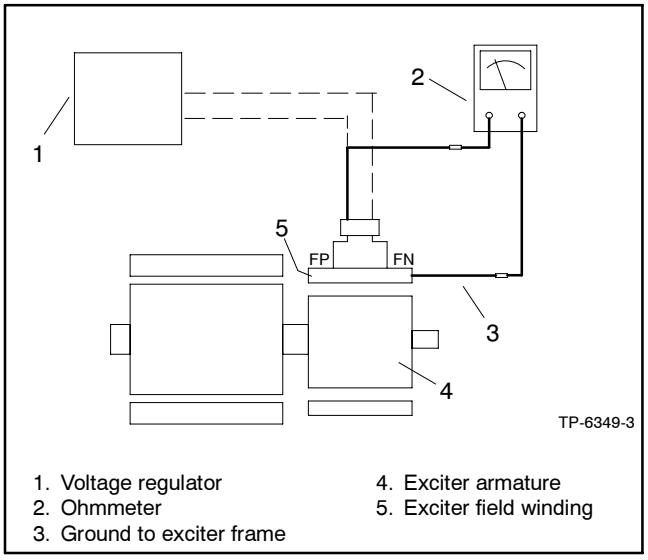


1. Voltage regulator
2. Ohmmeter
3. Exciter field winding
4. Exciter armature

Figure 3-9 Exciter Field Winding Resistance Test

A low reading indicates an internal short and a high reading indicates an open winding. Repair or replace the exciter field winding if the ohmmeter readings indicate an inoperative exciter field winding. If the resistance test is inconclusive, perform a megohmmeter test on the exciter field winding as described in the next step.

5. Check the exciter field winding for a short to ground condition. See Figure 3-10. Use a megohmmeter to apply 500 volts DC to the FP or FN lead and the exciter field winding frame. Follow the megohmmeter manufacturer's instructions for using the megohmmeter.



1. Voltage regulator
2. Ohmmeter
3. Ground to exciter frame
4. Exciter armature
5. Exciter field winding

Figure 3-10 Megohmmeter Connections on Exciter Field Winding

A reading of approximately 500 kOhms (1/2 megohm) and higher indicates the exciter field winding is good. A reading of less than approximately 500 kOhms indicates deterioration of the exciter field winding insulation and possible current flow to ground. Replace the exciter field winding.

3.6 Exciter Armature

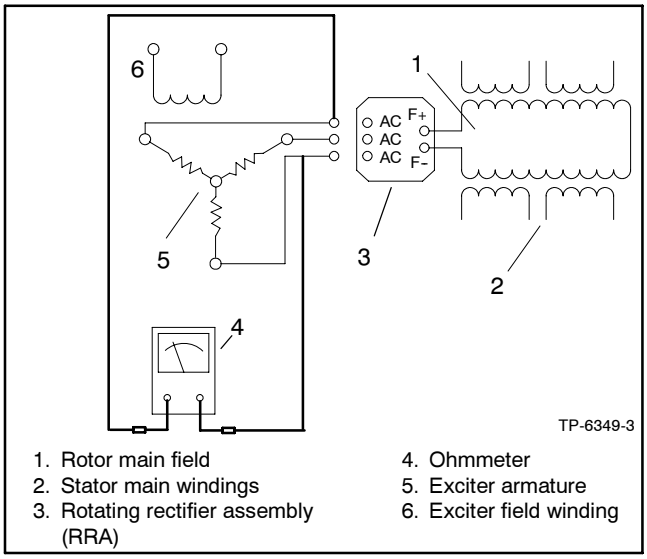
The exciter armature supplies excitation current to the main field windings through the rotating rectifier assembly (RRA). Test the exciter armature as described in the following steps.

Exciter Armature Test Procedure

1. Disassemble the alternator. See Section 4, Alternator Disassembly/Reassembly for the procedure.

2. With the alternator disassembled, disconnect the armature leads from the RRA AC terminals.

3. With an ohmmeter on the R x 1 scale, check the resistance across the exciter armature leads. See Figure 3-11. See Section 1, Specifications, for the armature resistance. No continuity indicates an open armature winding. If the resistance test is inconclusive, perform a megohmmeter test on the exciter armature as described in the next step.

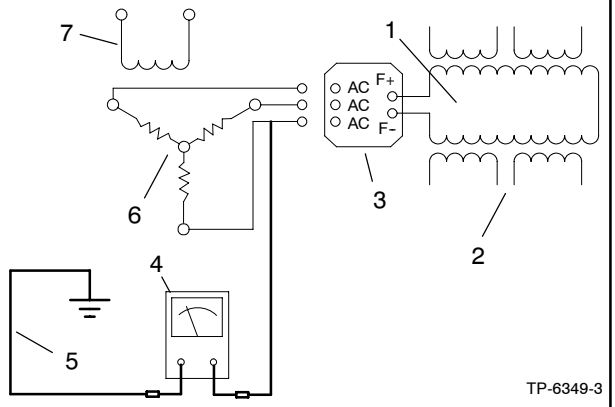


1. Rotor main field
2. Stator main windings
3. Rotating rectifier assembly (RRA)
4. Ohmmeter
5. Exciter armature
6. Exciter field winding

Figure 3-11 Exciter Armature Resistance Test

Note: Consider the exciter armature good if the resistance reading (continuity) is low and there is no evidence of a shorted winding (heat discoloration).

4. Check the exciter armature for a short to ground condition. Use a megohmmeter to apply 500 volts DC to either armature lead and the armature frame. Follow the megohmmeter manufacturer's instructions for using the megohmmeter. See Figure 3-12. A reading of approximately 500 kOhms (1/2 megohm) and higher indicates the exciter armature is good. A reading of less than approximately 500 kOhms indicates deterioration of the winding insulation and possible current flow to ground. Replace the exciter armature.



1. Rotor main field
2. Stator main windings
3. Rotating rectifier assembly (RRA)
4. Megohmmeter
5. Ground to exciter armature frame
6. Exciter armature
7. Exciter field winding

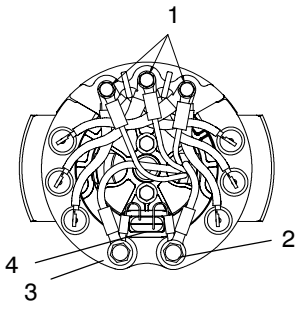
Figure 3-12 Megohmmeter Connections on Exciter Armature

3.7 Rotating Rectifier Assembly (RRA)/Varistor

The RRA converts the AC from the exciter armature to DC, which magnetizes the main field windings. Test the RRA as described in the following steps. The RRA consists of two diode assembly plates and varistor attached to the diode assembly hub. The diode assembly plates are available only as a set when ordering service parts.

Rotating Rectifier Assembly (RRA) Test Procedure

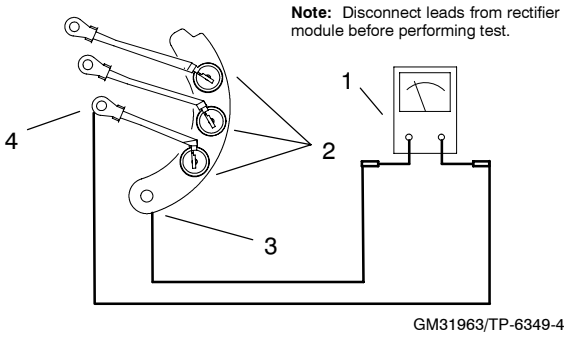
1. Disconnect the exciter armature and the rotor main field winding leads from the RRA. See Figure 3-13. Keep each lead electrically separated from the other leads and any metal components.



1. AC terminals
2. Diode terminal (F–)
3. Diode terminal (F+)
4. Varistor

Figure 3-13 RRA Connections

2. Use an ohmmeter on the R x 100 scale to check the resistance between the RRA diodes as shown in Figure 3-14. The ohmmeter should show a low resistance in one direction and, upon reversing the ohmmeter leads, a high resistance in the other direction. Replace the diode assembly plates (service part set) if any of the six diodes test differently than described.



1. Ohmmeter
2. Diodes (3 diodes per plate)
3. Diode ground connection
4. Diode terminal

Figure 3-14 Diode Assembly Plate (part of RRA) Test

3. Replace the varistor if there is evidence of heat damage. Replace the diode assembly hub if any damage is evident.

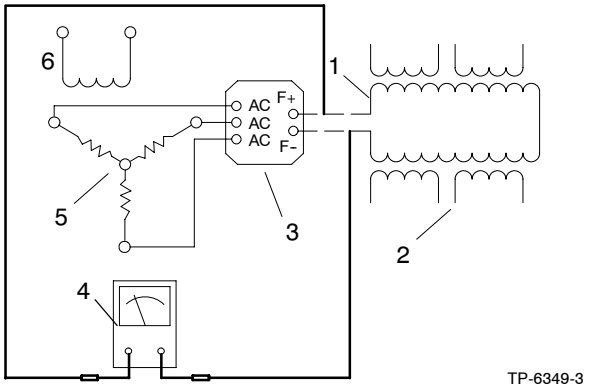
3.8 Rotor

The rotor (magnetized by DC from the rotating rectifier assembly) rotating within the stator induces AC in the stator windings. Test the rotor main field as described in the following steps. Disassemble the alternator prior to performing this test. See Section 4, Alternator Disassembly/Reassembly for the procedure.

Generator Rotor Test Procedure

1. With the alternator disassembled, disconnect the rotor main field from the rotating rectifier assembly (RRA) terminals F+ and F−.

2. Check the rotor main field resistance by connecting an ohmmeter across leads field F+ and F−. See Figure 3-15. See Section 1, Specifications for the resistance values.



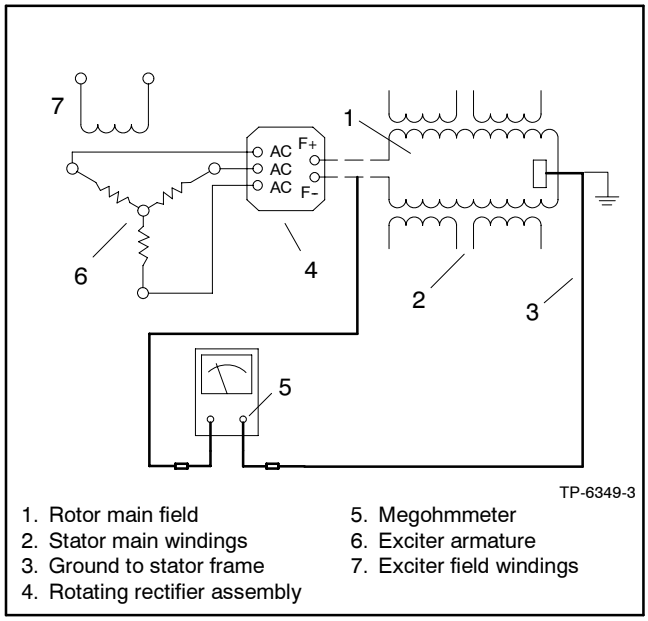
1. Rotor main field
2. Stator main windings
3. Rotating rectifier assembly
4. Ohmmeter
5. Exciter armature
6. Exciter field winding

Figure 3-15 Rotor Resistance Test

A low reading indicates an internal short and a high reading indicates an open winding. Repair or replace the rotor main field if the ohmmeter readings indicate the rotor main field is inoperative. If the resistance test is inconclusive, perform a megohmmeter test on the rotor main field as described in the next step.

3. Check the rotor main field for a short to ground condition by using a megohmmeter. Apply 500 volts DC to either rotor main field lead and the main field frame. Follow the megohmmeter manufacturer's instructions for using the megohmmeter. See Figure 3-16.

   A reading of 500 kOhms (1/2 megohm) and higher indicates the rotor main field is good. A reading of less than 500 kOhms indicates deterioration of the rotor main field winding insulation and possible current flow to ground. Replace the rotor.



1. Rotor main field
2. Stator main windings
3. Ground to stator frame
4. Rotating rectifier assembly
5. Megohmmeter
6. Exciter armature
7. Exciter field windings

Figure 3-16 Megohmmeter Connections on Rotor Main Field

3.9 Stator

The stator consists of a series of coils of wire (windings) laid in a laminated steel frame. The stator leads supply voltage to the AC load and voltage regulator.

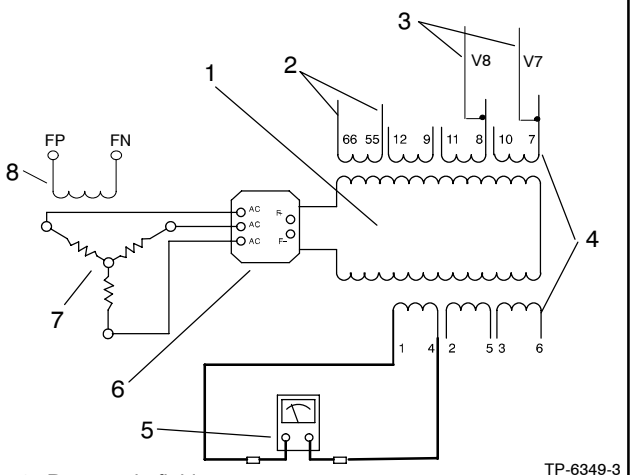
Before testing the stator, inspect it for heat discoloration and visible damage to the housing lead wires and exposed and varnished areas of the frame laminations. Be sure the stator is securely fastened in the stator housing.

The stator produces electrical output (AC) as the magnetized main field rotates within the stator windings. Test the condition of the stator according to the following procedure.

Leads 1–4 (single phase) or leads 1–12 (three phase) are the alternator AC output leads. Leads 55 and 66 are the voltage regulator supply and sensing leads. Refer to Figure 3-17 and Figure 3-18 (three phase) or Figure 3-19 and Figure 3-20 (single phase) when performing the following tests.

Between Leads	Continuity
1 and 4	Yes
2 and 5	Yes
3 and 6	Yes
7 and 10	Yes
8 and 11	Yes
9 and 12	Yes
55 and 66	Yes
1 and 2, 5, 3, 6, 7, 10, 8, 11, 9, 12	No
1 and 55, 66	No
Any stator lead and ground	No

Figure 3-17 Stator Continuity, Three Phase

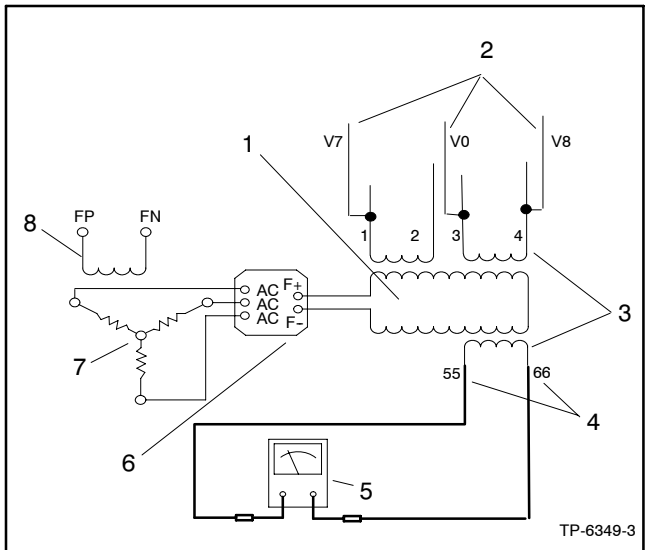


1. Rotor main field
2. Sensing leads (208–240 volts nominal)
3. Voltage regulator power supply leads
4. Stator main windings
5. Ohmmeter
6. Rotating rectifier assembly (RRA)
7. Exciter armature
8. Exciter field winding

Figure 3-18 Stator Ohmmeter Connections, 3-Phase

Between Leads	Continuity
1 and 2	Yes
3 and 4	Yes
55 and 66	Yes
1 and 3, 4, 33, 44	No
1 and 55	No
Any stator lead and ground	No

Figure 3-19 Stator Continuity, Single Phase



1. Rotor main field
2. Sensing leads (208–240 volts nominal)
3. Stator main windings
4. Voltage regulator power supply leads
5. Ohmmeter
6. Rotating rectifier assembly (RRA)
7. Exciter armature
8. Exciter field winding

Figure 3-20 Stator Ohmmeter Connections, Single Phase

Stator Test Procedure

1. Move the generator set master switch to the OFF/RESET position.

2. Disconnect the generator set engine starting battery, negative (–) lead first.

3. Check the alternator output lead connections. Refer to wiring diagram manual and/or generator set operation manual.

4. Disconnect all the stator leads to isolate the windings. To check the stator continuity, set the ohmmeter on the R x 1 scale. Check the stator continuity by connecting the meter leads to the stator leads as shown in Figure 3-20. Perform the stator tests on all of the stator windings. For single-phase alternators use Figure 3-19. For three-phase alternators use Figure 3-17.

5. Contact the ohmmeter leads and readjust the ohmmeter to zero ohms. Check the cold resistance of the stator windings by connecting the meter leads to the stator leads 1-2, 3-4, etc. See Section 1, Specifications, for the stator resistance values. If the stator resistance test is inconclusive, perform a megohmmeter test on the stator as described in the next step.

Note: Consider the stator good if the resistance reading (continuity) is low and there is no evidence of shorted windings (heat discoloration).

Note: When taking an ohmmeter reading using lead 55, make the connection prior to the in-line fuse.

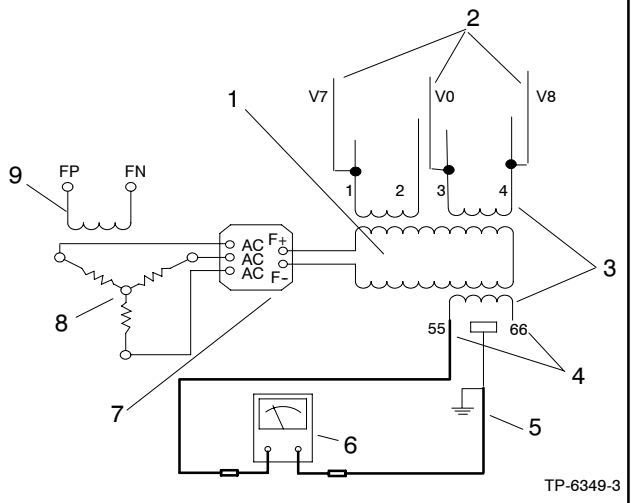
Note: The stator resistance varies directly with increased temperature.

6. If any of the stator readings vary during the previous checks, replace the stator.

7. Check the stator for a short to ground condition using a megohmmeter. See Figure 3-21 and Figure 3-22.

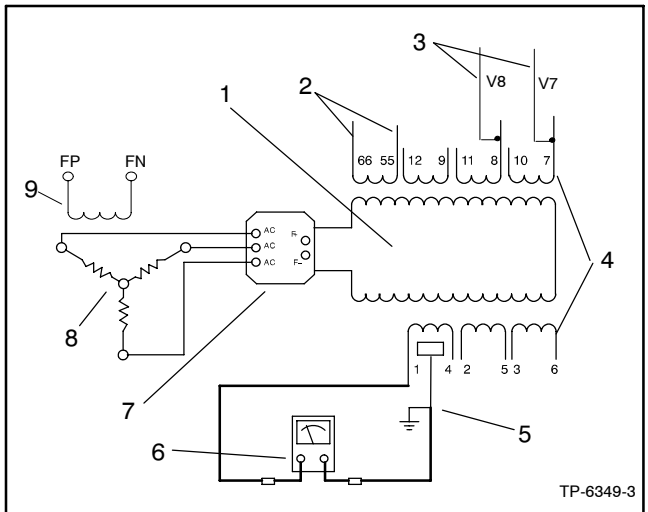
   Apply 500 volts DC to any stator lead from each winding and the stator frame. Follow the megohmmeter manufacturer's instructions for using the megohmmeter. Repeat the test on the other leads until all the stator windings have been tested.

   A reading of 500 kOhms (1/2 megohm) and higher indicates the stator is good. A reading of less than 500 kOhms indicates deterioration of the stator winding insulation and possible current flow to ground. Repair or replace the stator.



1. Rotor main field
2. Sensing leads (208-240 volts nominal)
3. Stator main windings
4. Voltage regulator power supply leads
5. Ground to stator frame
6. Megohmmeter
7. Rotating rectifier assembly (RRA)
8. Exciter armature
9. Exciter field winding

Figure 3-21 Megohmmeter Connections on Stator, Single Phase



1. Rotor main field
2. Sensing leads (208-240 volts nominal)
3. Voltage regulator power supply leads
4. Stator main windings
5. Ground to stator frame
6. Megohmmeter
7. Rotating rectifier assembly (RRA)
8. Exciter armature
9. Exciter field winding

Figure 3-22 Megohmmeter Connections on Stator, Three Phase

3.10 Speed Sensor Test

Follow the procedure outlined below to determine if the speed sensor (overspeed fault) is emitting a signal.

Note: During the test the controller leads must remain connected to the speed sensor terminals. Slide leads from speed sensor terminals only enough to expose connection for the test leads. **Do not disconnect** the speed sensor leads.

1. Move the generator set master switch to the OFF/RESET position.

2. Connect a DC voltmeter between positive (+) lead (wire 24) at speed sensor and ground (wire 2). The voltmeter should indicate approximately 8-10 volts DC.

3. Move the generator set master switch to the RUN position to start the generator set.

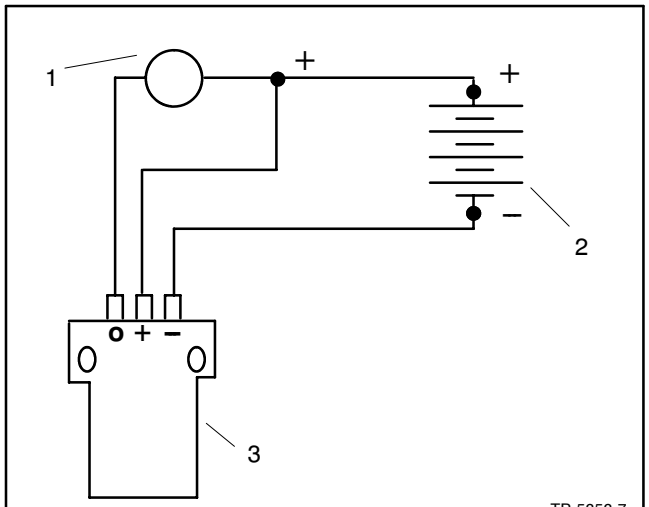
4. With generator set running, connect the DC voltmeter negative probe to the 0 terminal (wire 16—white) on the speed sensor. Place the voltmeter positive probe on positive (+) terminal (wire 24—red). The voltmeter should indicate approximately 12 volts DC.

If the speed sensor is emitting a signal, check the continuity of the speed sensor leads (wires 2, 16, and

24) between the controller connector and lead terminals at speed sensor.

If the speed sensor is not emitting a signal, test the speed sensor using the following procedure:

1. Connect the speed sensor, voltmeter, and DC voltage source as shown in Figure 3-23.



1. DC Voltmeter
2. 12-Volt Battery or DC Power Supply
3. Sensing Surface

Figure 3-23 Speed Sensor Test

2. Touch the sensing surface with a flat piece of iron or steel—at least 4 cm (1/4 cu. in.) in size.

3. The voltmeter test reading should equal the source voltage.

4. Remove the iron or steel from the sensing surface and observe a no voltage reading on the voltmeter.

3.11 Interface Circuit Board GM11718

The 550 controller has an integral voltage regulator. Circuit board GM11718 interfaces between the wound field alternator and 550 controller voltage regulator. See Figure 3-24 for an illustration of the circuit board. The circuit board is typically located in the junction box.

There is no field test for this circuit board. Use the following information to help troubleshoot the circuit board.

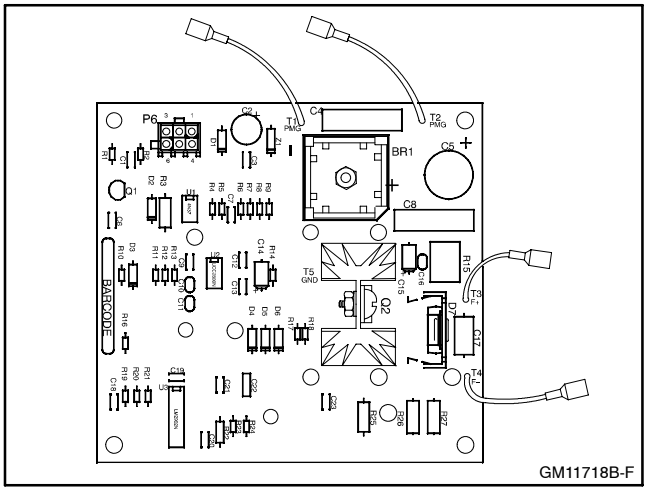


Figure 3-24 Interface Circuit Board GM11718

Verify connection and continuity of the wires shown in Figure 3-25 and Figure 3-26. Check the wires for broken strands and damaged insulation including cuts and chafing. Check the terminals for corrosion and loose electrical connections. Repair and/or replace any defective wiring.

Wire	Circuit Board Connection	Component Connection
E12	P6-1	TB3-1
N	P6-2	TB3-7
EOV	P6-3	TB4-4
3B	P6-4	P1-16
5B	P6-5	P1-20
Not used	P6-6	none
55	T1	Stator main field 55
66	T2	Stator main field 66
F1	T3	Exciter field IB-F (+)
F2	T4	Exciter field IB-F (-)

Figure 3-25 Interface Circuit Board Connections

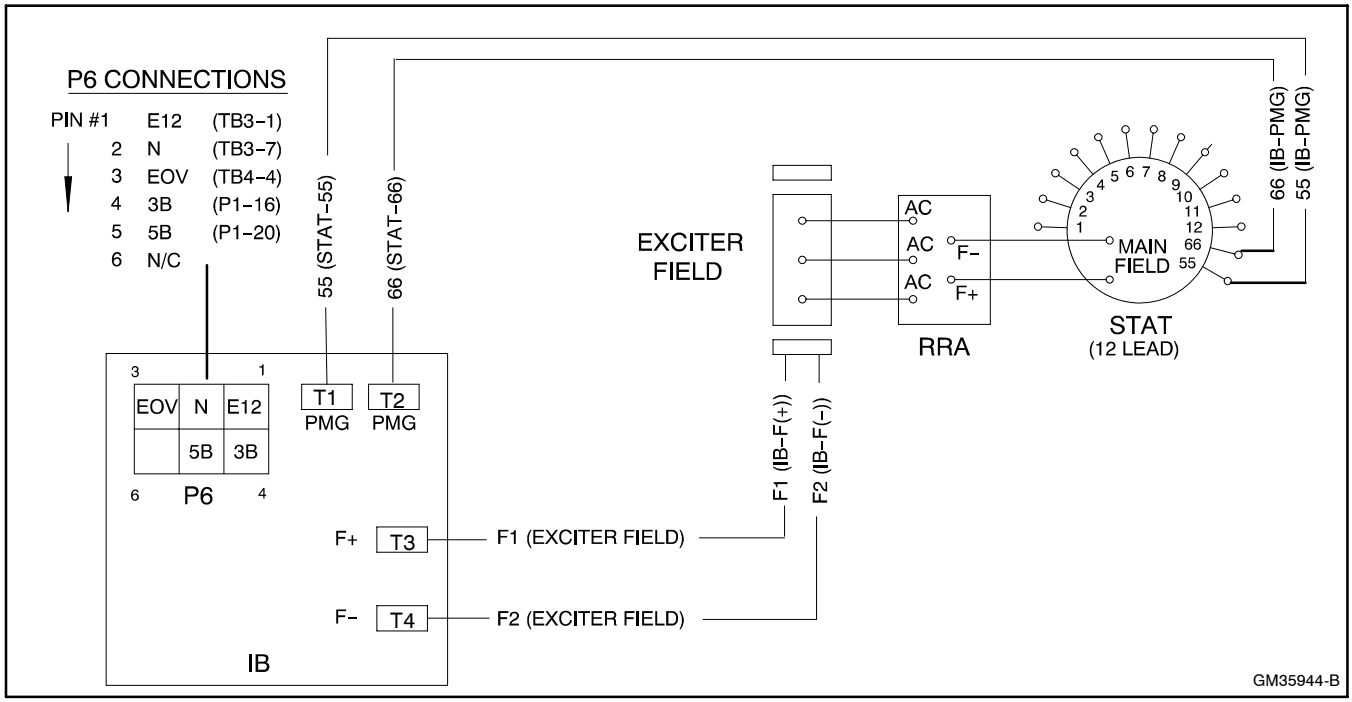


Figure 3-26 Interface Circuit Board Diagram with Wound Field Alternator

Do the checks shown in Figure 3-27. Shut down the unit after performing the start and run checks.

If the circuit board is still suspected of questionable function after the circuit board wiring checks out okay, replace with a known good circuit board and test the generator set for functionality.

Connections/Display	Check	Possible Causes
P6-E12 and P6-N connections	12 VDC supply from 550 controller	Check battery and/or connections
		Check P6 connector and wiring
P6-3B and P6-5B connections (start and run unit for this test)	1-3 VDC output	Check controller interconnection P1 connector and wiring
		Check T3 and T4 connections (field wires)
		Check F1 and F2 winding and connections at exciter field
Field overvoltage fault display on 550 controller	P6-EOV connection	Check if P6-EOV is grounded
T1 and T2 (PMG connections) (start and run unit for this test)	200-230 VAC stator output	Check T1 and T2 (PMG) connections
		Check 55 and 66 winding and connections at stator
F+ and F- connections	DC voltage (values are alternator dependant)	Check T3 and T4 connections (field wires)
		Check F1 and F2 winding and connections at exciter field

Figure 3-27 Interface Circuit Board GM11718 Testing

Notes

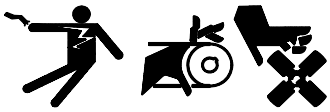
4.1 General

Before beginning alternator disassembly procedure, carefully read all safety precautions at the beginning of this manual. Please observe these precautions and those included in text during the disassembly/reassembly procedure.

The following procedures cover many models and some steps may not apply to a particular engine. Use Figure 4-1 or Figure 4-2 to help understand component descriptions and general configuration of the alternator.

Use the disassembly procedure as a guideline to help take apart the alternator. The disassembly procedure provides important information to minimize disassembly time and indicates where special configurations exist which may require taking notes. The reassembly procedure includes important alignment steps and provides special torque specs.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

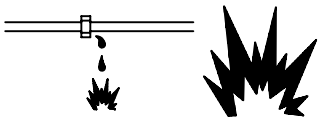
⚠ WARNING

Hot engine and exhaust system.
Can cause severe injury or death.

Do not work on the generator set until it cools.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

⚠ WARNING



Explosive fuel vapors.
Can cause severe injury or death.

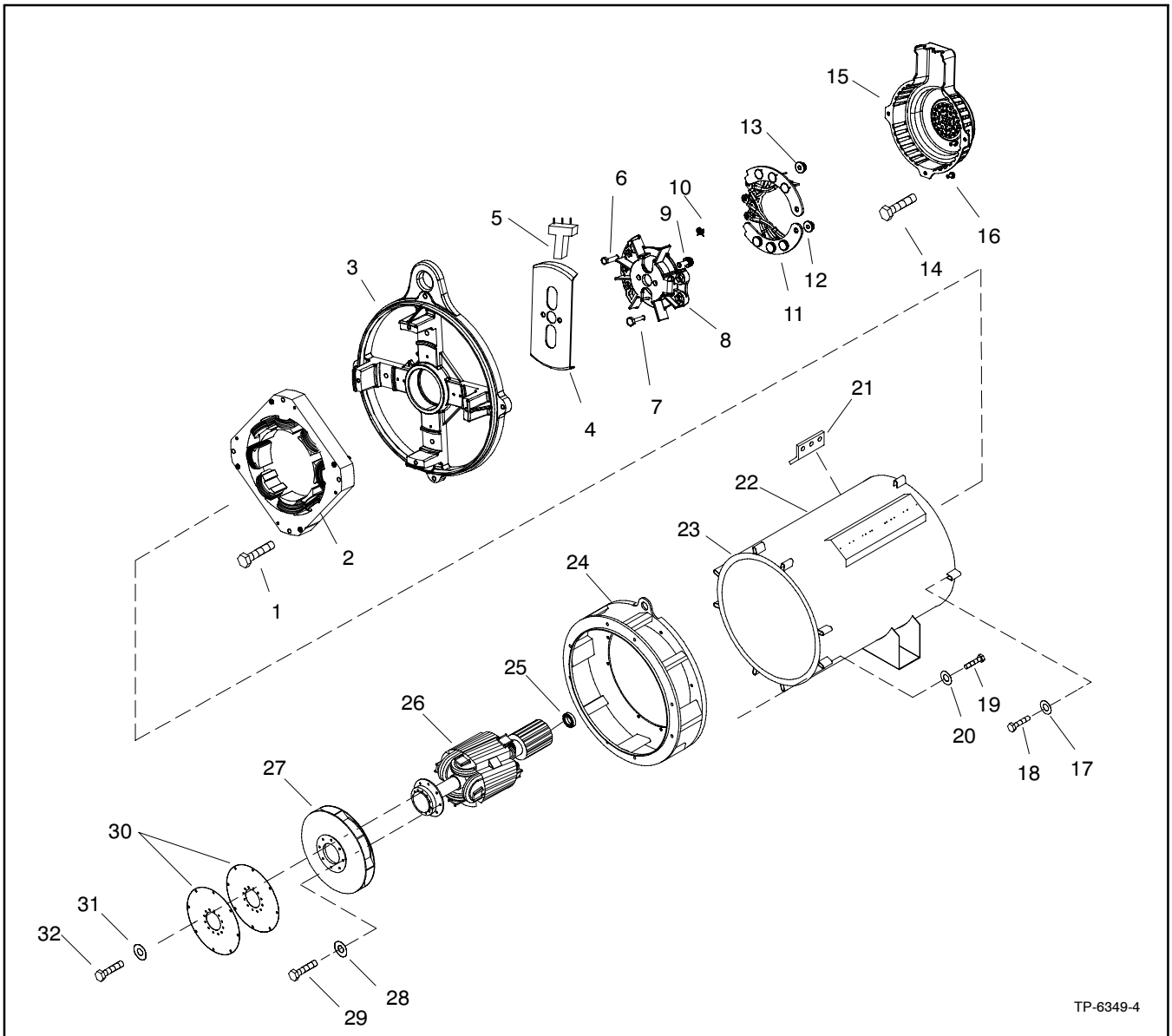
Use extreme care when handling, storing, and using fuels.

The fuel system. Explosive fuel vapors can cause severe injury or death. Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

Explosive fuel vapors can cause severe injury or death. Take additional precautions when using the following fuels:

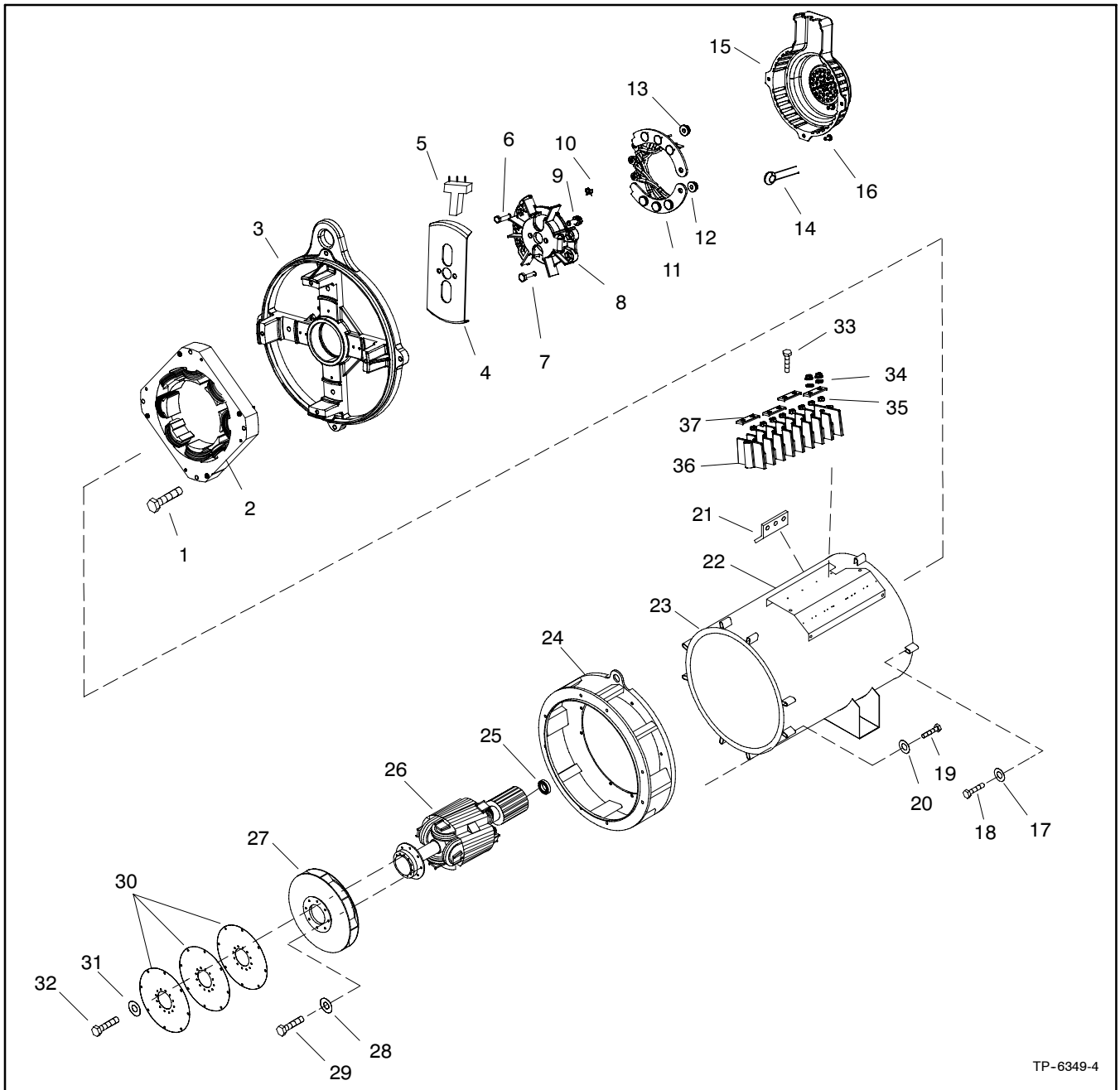
Gasoline—Store gasoline only in approved red containers clearly marked GASOLINE.

Propane (LP)—Adequate ventilation is mandatory. Because propane is heavier than air, install propane gas detectors low in a room. Inspect the detectors per the manufacturer's instructions.



1. Screw
2. Exciter field winding
3. End bracket
4. Magnetic actuator
5. Speed sensor
6. Screw
7. Screw
8. Rotating rectifier assembly hub
9. Screw
10. Nut
11. Diode assembly plates (2 pieces—red and blue)
12. Elastic stop nut
13. Elastic stop nut
14. Varistor
15. Rotating rectifier assembly cover
16. Screw
17. Plain washer
18. Screw
19. Screw
20. Plain washer
21. Terminal
22. Equipment ground decal
23. Stator
24. Adapter
25. Ball bearing
26. Rotor
27. Alternator fan
28. Plain washer
29. Screw
30. Drive discs (2)
31. Hardened washer
32. Screw

Figure 4-1 4PW and 4QW Alternator Components, 20–60 kW



1. Screw
2. Exciter field assembly
3. End bracket
4. Magnetic actuator
5. Speed sensor
6. Screw
7. Screw
8. Rotating rectifier assembly hub
9. Screw
10. Nut
11. Diode assembly plates (2 pieces—red and blue)
12. Elastic stop nut
13. Elastic stop nut
14. Varistor
15. Rotating rectifier assembly cover
16. Screw
17. Plain washer
18. Screw
19. Screw
20. Plain washer
21. Terminal
22. Equipment ground decal
23. Stator
24. Adapter
25. Ball bearing
26. Rotor
27. Alternator fan
28. Plain washer
29. Screw
30. Drive discs, 3 with 4SW/4VW and 4 with 4UAW
31. Hardened washer
32. Screw
33. Screw
34. Plain washer
35. Nut
36. Terminal block
37. Terminal block link

Figure 4-2 4SW, 4VW, and 4UAW Alternator Components, 60 kW IMS-300 kW

Perform the following steps prior to disassembling the generator set.

1. Disconnect (negative lead first) and remove the starting batteries from the work area to prevent a fire hazard. Disconnect AC-powered accessories, such as the battery charger, block heater, and fuel transfer pump.

2. Shut off the fuel supply. Drain the fuel system as necessary by emptying the fuel into proper containers. Remove any fuel containers from the work area to prevent a fire hazard. Ventilate the work area to clear fumes.

3. Disconnect the fuel, cooling, and exhaust systems as necessary to tilt the generator set. Disconnect the output leads or load circuit cables at the generator set.

4. Any cranes, hoists, or other lifting devices used in the disassembly or reassembly procedure must be rated for the weight of the generator set. Check the generator set nameplate or spec sheet for weight.

5. Remove the junction box panels.

4.2 Disassembly

1. Disconnect all controller-to-engine and engine-to-alternator harnesses and wiring. Disconnect the speed sensor wiring. Remove the junction box and the controller as a unit.

2. Remove the fan guard.

3. Remove the rotating rectifier assembly housing.

4. Remove the alternator (rodent) guard on the end bracket (if equipped).

5. Remove the speed sensor from the end bracket.

6. Remove all leads from the three AC terminals on the rotating rectifier assembly hub. See Figure 4-3. Make notes as needed for reconnection later.

7. Remove the leads from the F+/F– terminals on the rotating rectifier assembly hub. Make notes as needed for reconnection later. Remove the diode assembly plates. The varistor is accessible after the F+/F– screws are removed.

8. Remove the two mounting screws. Lift off the rotating rectifier assembly hub and magnetic actuator.

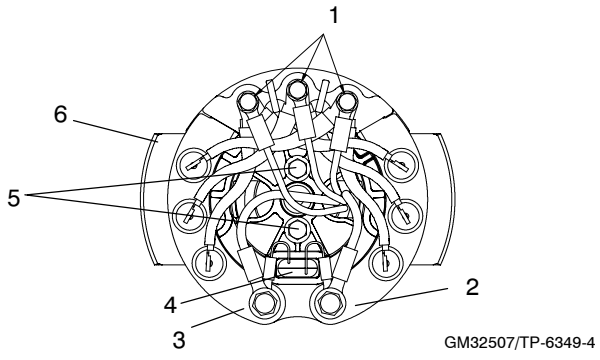
9. Remove bolts from the alternator vibromounts.

10. Suspend the alternator at both ends with hooks in lifting eyes. Use a hoist to raise alternator end off vibromounts. See Figure 4-4.

11. Support the engine by placing wood blocks under the flywheel housing. Lower the alternator end until the flywheel housing rests on the blocks. See Figure 4-4.

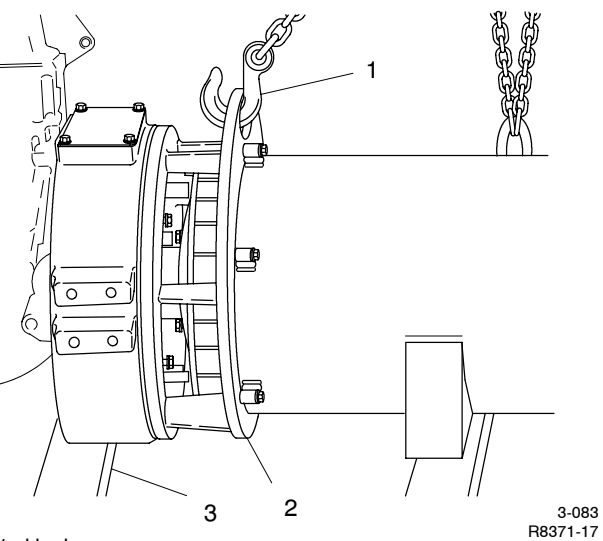
12. Remove the bolts holding the adapter to the flywheel housing.

13. Remove the hardware attaching the drive discs to the flywheel.



1. AC terminals
2. Diode terminal (F–) (red)
3. Diode terminal (F+) (blue)
4. Varistor
5. Mounting screws
6. Magnetic actuator

Figure 4-3 Rotating Rectifier Assembly Hub and Components



1. Hook
2. Alternator adapter
3. Wood block(s)

Figure 4-4 Hoisting Generator

14. Work the drive discs over the studs (if equipped) to separate the alternator from the engine. See Figure 4-5.

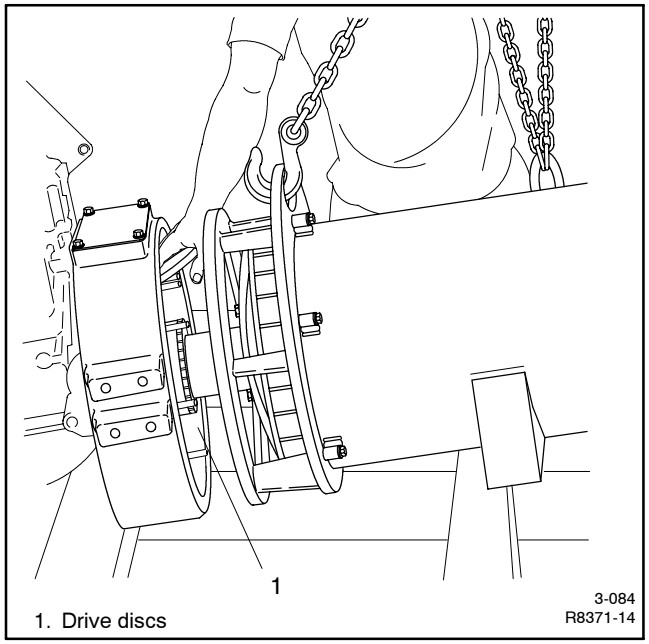


Figure 4-5 Separating Generator and Engine

15. Use a stud remover and remove the studs from the flywheel, if damaged.

16. Set the alternator assembly on the floor in a horizontal position. Remove the support slings or chains.

17. To remove the rotor assembly, attach the hoist hook to the adapter and lift the alternator assembly to a vertical position. See Figure 4-6. Place boards along the edge of the end bracket to prevent damage to the rotating rectifier assembly hub and magnetic actuator. Lower the rotor assembly.

18. Remove the drive discs and fan from the alternator assembly. See Figure 4-6.

19. Fasten the lifting eye and hoist hook to the rotor flange. Hoist the rotor carefully to avoid damaging the exciter armature or exciter field winding. See Figure 4-7.

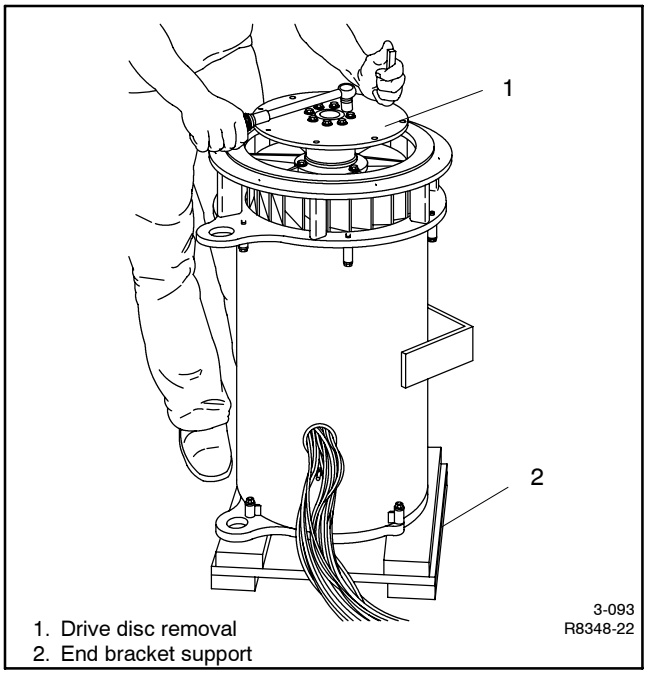


Figure 4-6 Alternator Support, Drive Discs, and Fan Removal

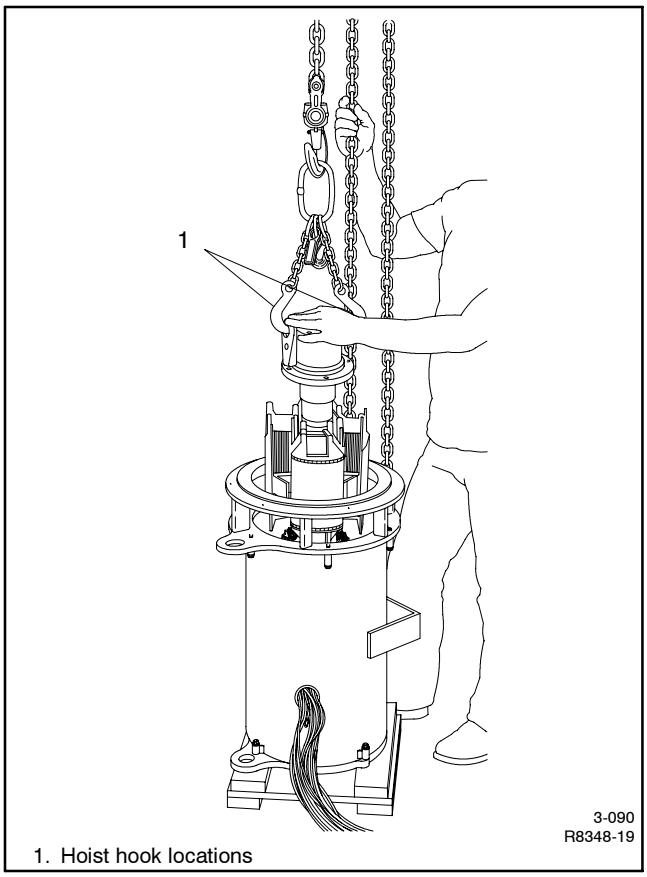


Figure 4-7 Rotor Removal

20. Place a pallet or other wooden surface under the rotor and slowly lower the rotor to a horizontal position. Take care not to damage the windings, laminations, or bearing. See Figure 4-8.

21. Make note of the bearing location dimensions from the rotor shaft end for reference during installation if the bearing will be removed. Use a hydraulic press to remove the bearing, if needed.

22. Place the alternator assembly on the adapter end in order to remove the adapter and end bracket from the stator. Fasten chains to the adapter and lower to a horizontal position. Fasten the hoist hook to the end bracket eye and lift to a vertical position. See Figure 4-9.

23. Remove the adapter mounting bolts. Fasten the hoist hooks to the end bracket and raise the stator assembly slightly. Tap adapter loose by using a rubber mallet.

24. Lower the stator assembly. Remove the end bracket mounting bolts. Separate the end bracket from the stator by tapping loose with a rubber mallet.

25. Remove the exciter field winding from the end bracket.

4.3 Reassembly

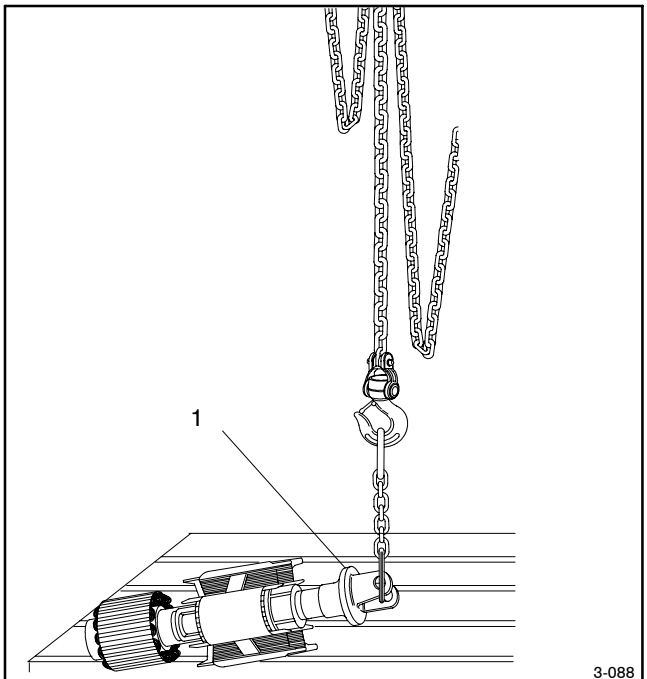
Follow the general guidelines in the following procedure. In addition, Figure 4-23, Figure 4-24, and Figure 4-25 at the end of this section may provide some detailed help during the reassembly procedure.

When torque specifications are not shown in Section 1, Specifications, use the guidelines shown in Appendix C, General Torque Specifications.

1. Attach the exciter field to the end bracket with four mounting bolts. Torque to specifications.

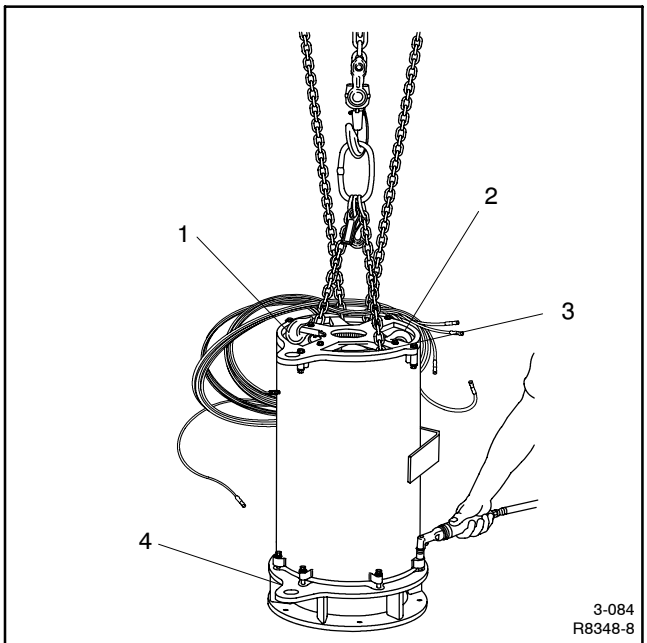
2. Place the stator in a vertical position with the end bracket side up.

   Note: The end bracket side of the stator has four mounting bosses.



1. Rotor assembly

Figure 4-8 Lowering Rotor

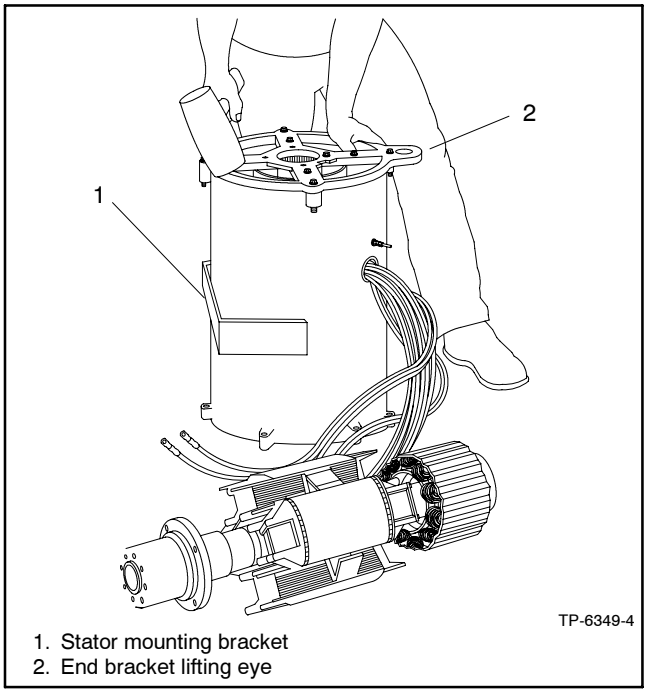


1. Hoist hook
2. Hoist hook
3. End bracket
4. Adapter

Figure 4-9 Removing Alternator Adapter

3. Position the end bracket housing eye opposite the stator mounting bracket during reassembly. See Figure 4-10.

   Place the end bracket on the stator and use bolts to align the holes. Use a rubber mallet to mount the end bracket flush with the stator.



1. Stator mounting bracket
2. End bracket lifting eye

Figure 4-10 Attaching End Bracket on Stator

4. Attach the end bracket to the stator using the original hardware. Torque to specifications.

5. Attach the hoist hooks to the end bracket and suspend the stator. Place the adaptor on the floor and lower the stator to within 12.7–6.4 mm (1/2–1/4 in.) of the adapter lip. See Figure 4-11.

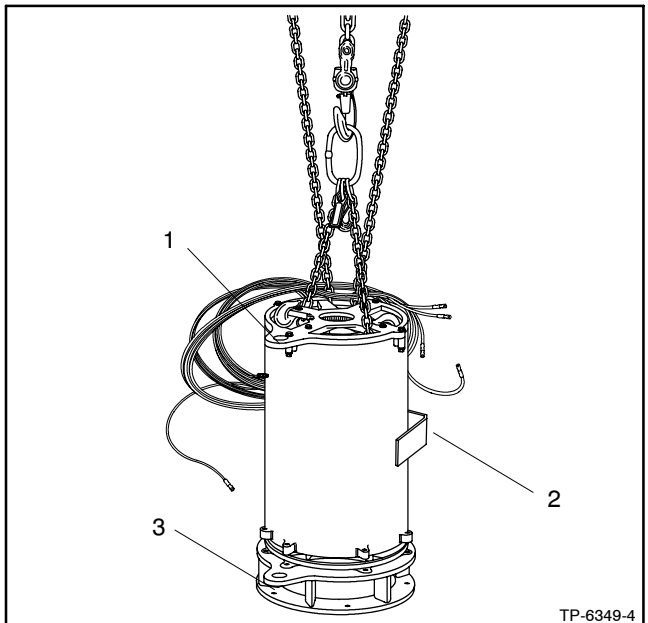
6. Position the adapter hoisting eye opposite of the stator mounting bracket and directly below the end bracket hoisting eye.

   Align the adapter with the stator and start the bolts with washers. Lower the stator onto the adapter and finish tightening the bolts. Torque to specifications.

7. Lower the alternator assembly to a horizontal position.

8. Attach the hoisting hooks to the adapter as shown in Figure 4-12. Suspend the alternator assembly. Before lowering the alternator assembly, place boards along the edge of the end bracket. Maintain a 25 mm (1 in.) clearance underneath the center of the end bracket to allow for rotor shaft clearance.

9. Rotor shaft bearing installation. Use a hydraulic press, bearing heater, or heavy rubber mallet and a piece of round steel stock with an outside diameter less than the bearing inner race to install the new bearing using measurements taken during the disassembly procedure.



1. End bracket lifting eye
2. Stator mounting bracket
3. Adapter lifting eye

Figure 4-11 Aligning Adapter and Stator

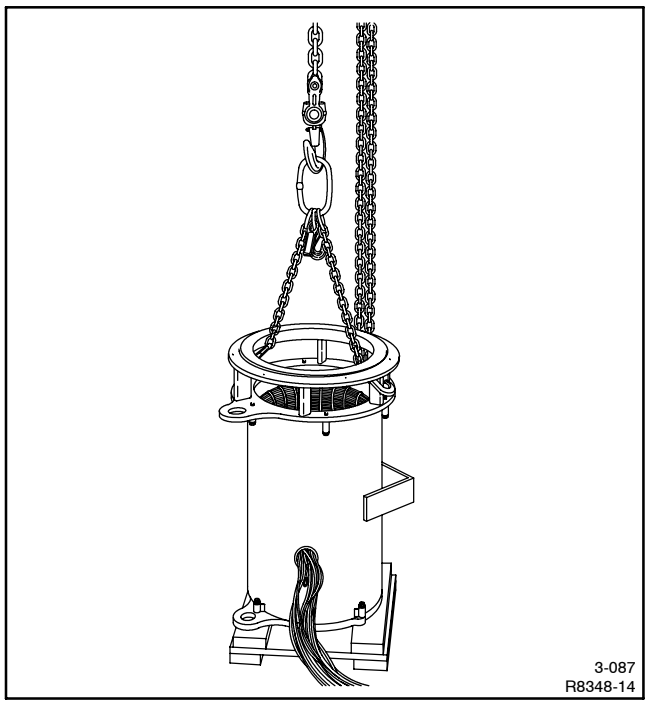
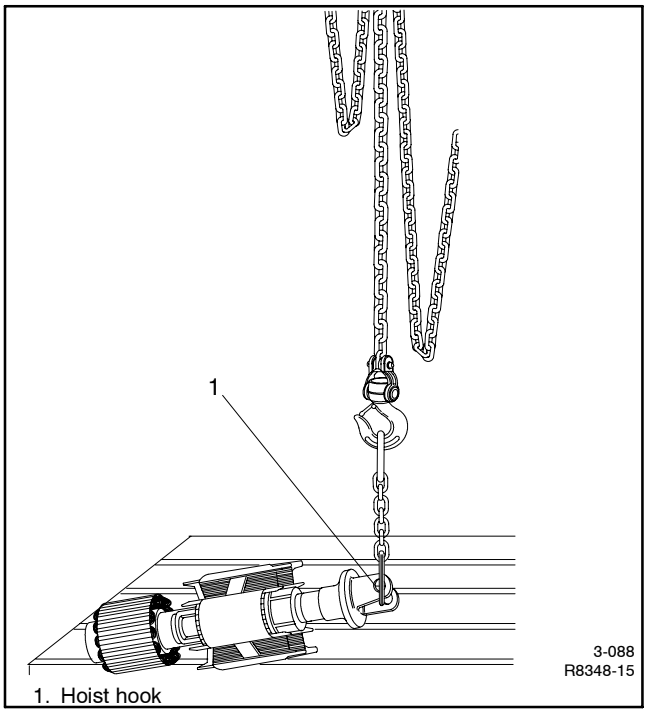


Figure 4-12 Supporting Alternator Assembly

10. Fasten the lifting eye and hoist hook to the rotor flange. See Figure 4-13. Hoist the rotor to a vertical position taking care not to damage windings, laminations, or bearing.



1. Hoist hook

Figure 4-13 Hoisting Rotor

11. Suspend the rotor over the alternator assembly. Lower the rotor into the stator. Be extremely careful while lowering the rotor to avoid damaging the exciter field assembly, stator windings, or rotor laminations. See Figure 4-14. Carefully align rotor bearing into end bracket.
12. Place the fan over the rotor flange and the torque bolts to specifications.
13. Align the individual drive disks with the hex holes together and with the hole burr sides facing the same direction. Temporarily place two alignment pins (not supplied) or bolts in the outer holes at opposite ends and 90° from the hex hole before installing the drive disk to the rotor shaft. The pins help maintain concentric alignment of the individual drive disks during installation. See Figure 4-15.

    Note: The user-supplied pins should be no smaller than 0.025 mm (0.001 in.) of the disc hole diameter.

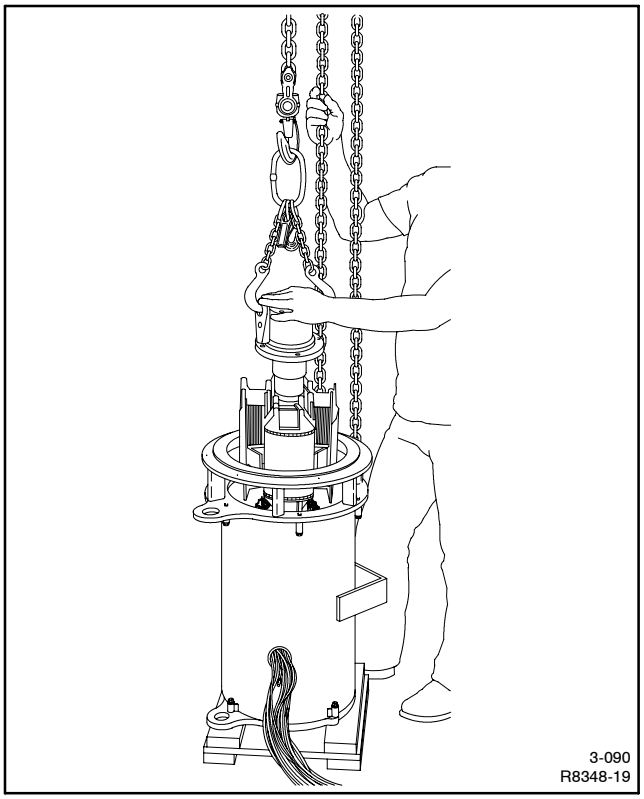
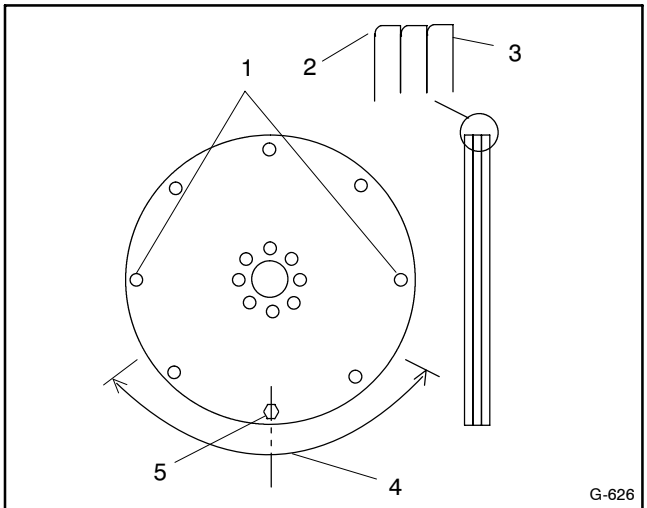


Figure 4-14 Installing Rotor



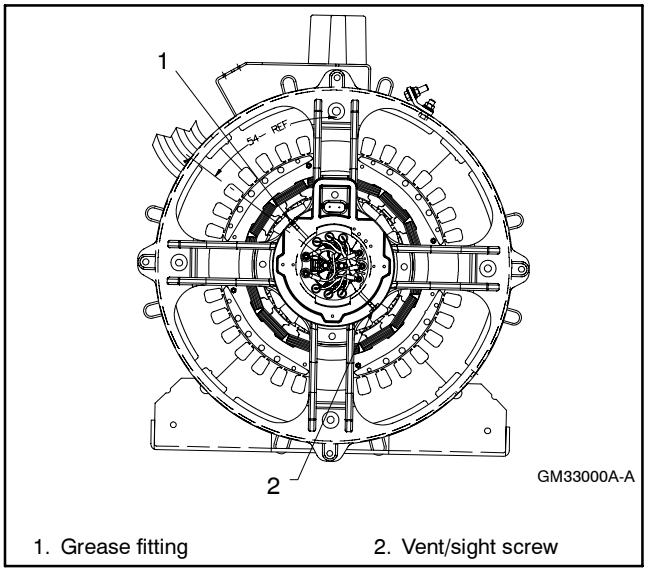
1. Install alignment pins or bolts here
2. Rolled corner
3. Burr side
4. 120° total; position drive disk hex hole at the stator bottom position or within 60° CW or CCW from the stator bottom position
5. Hex hole

Figure 4-15 Aligning and Mounting Drive Disks

14. Attach the drive disc(s) to end of rotor shaft with the hole burr side toward the alternator fan and with the hex hole at the stator bottom position or within 60° clockwise (CW) or counterclockwise (CCW) of the bottom position as viewed when the stator is installed on the skid. Torque the drive disc(s) mounting bolts to specifications. Remove the two alignment pins or bolts.

15. Attach a hoist to the adapter eye and place the alternator assembly in a horizontal position. Take care not to damage the rotor or stator. Place the hoisting eyes of the alternator to the top.

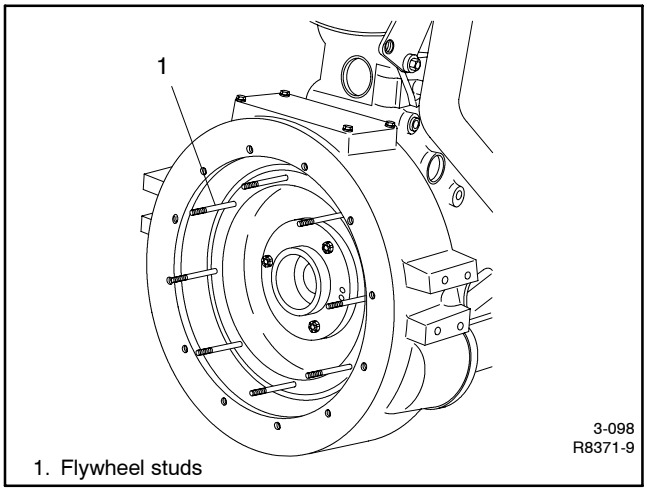
16. **UA alternator only.** Remove the vent/sight hole screw from the end bracket located 180° from the grease fitting. Use a grease gun and fill with Chevron SRI2 or equivalent lithium-based grease until the grease is visible at the vent/sight hole. Wipe excess grease from the end bracket. Replace the vent/sight hole screw and torque to specifications. See Figure 4-16.



1. Grease fitting
2. Vent/sight screw

Figure 4-16 Applying Grease to UA Alternator

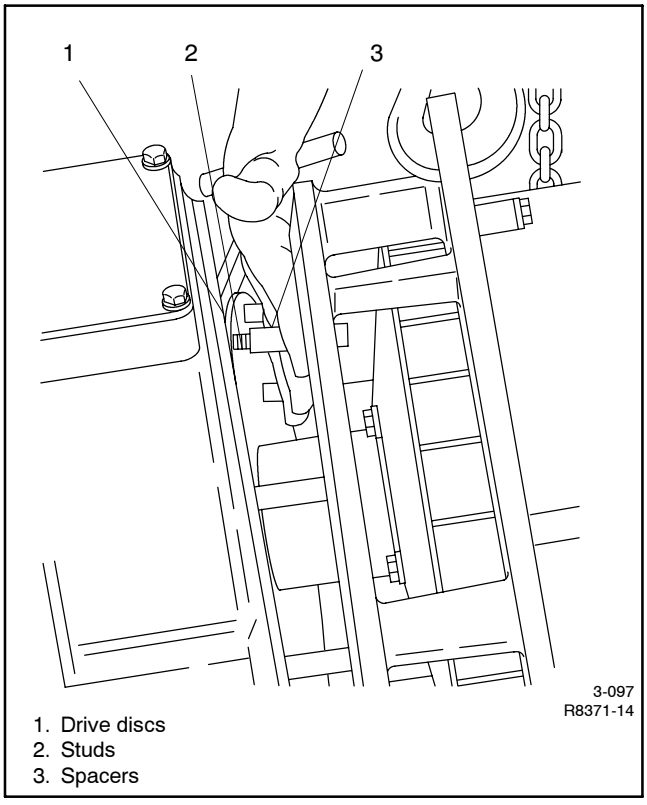
17. Apply Loctite® No. 271 red to stud threads and install into flywheel as shown in Figure 4-17. Install studs completely into flywheel. Apply Loctite® No. 242 blue to stud threads on nut side.



1. Flywheel studs

Figure 4-17 Flywheel Studs

18. Place hoist hooks into the end bracket and adapter eye. Raise the alternator assembly and align the studs with the drive discs by turning the flywheel. Move the alternator as necessary to work the drive discs over the studs. When the drive discs are about 25 mm (1 in.) over studs, install spacers if so equipped. See Figure 4-18.



1. Drive discs
2. Studs
3. Spacers

Figure 4-18 Installing Spacers

Loctite® is a registered trademark of Loctite Corporation.

19. Move the alternator as necessary to align the adapter and the flywheel housing. Fasten and final tighten the adapter to the flywheel housing using bolts and hardened lock washers. See Figure 4-19. Torque the bolts to specifications.

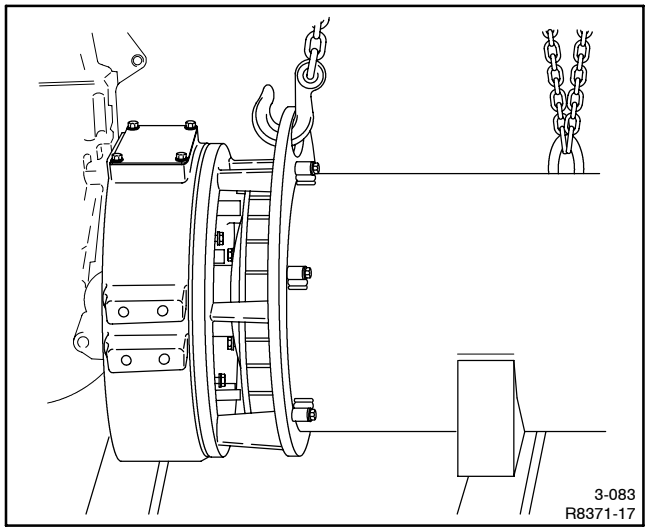


Figure 4-19 Aligning Adapter to Flywheel Housing

20. Install the hardware attaching the drive discs to the flywheel. Do not final tighten at this time.

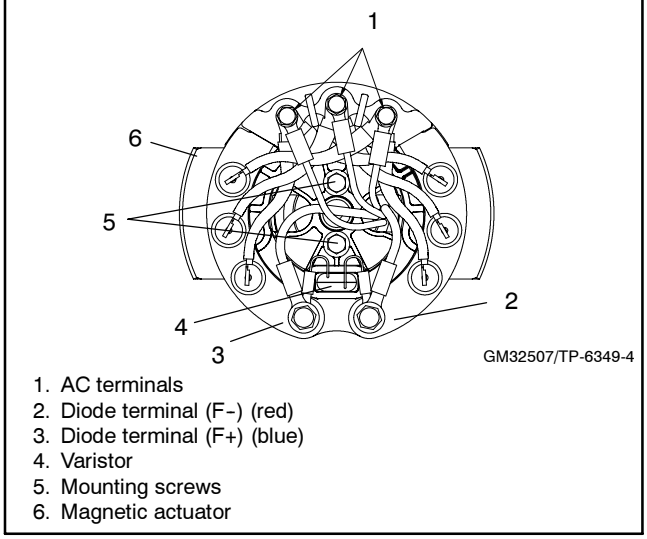
    Note: Some applications use hardened washers. Do not substitute with non-hardened washers.

21. Hoist the alternator and engine slightly to remove the wood block(s) from under the flywheel housing. Align the alternator assembly and the skid. Lower the alternator and tighten the vibromount mounting bolts.

22. Remove the chains or slings from the alternator. Final tighten the drive discs to the flywheel. Torque the hardware to specifications.

23. Mount the rotating rectifier assembly hub and magnetic actuator to the rotor shaft using two screws. Torque to specifications.

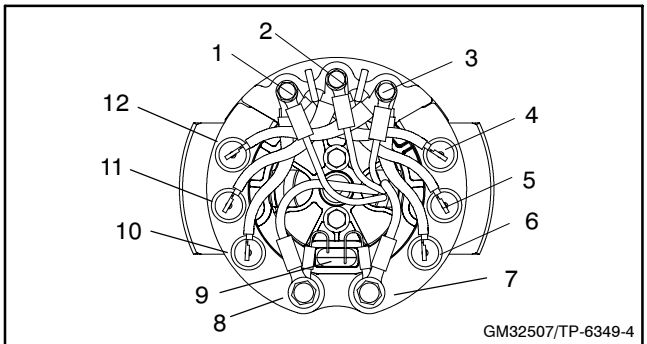
24. Replace the diode assembly plates and varistor if removed. The diode assembly plates are color coded. The positive diode assembly is blue and the negative diode assembly is red. See Figure 4-20.



1. AC terminals
2. Diode terminal (F-) (red)
3. Diode terminal (F+) (blue)
4. Varistor
5. Mounting screws
6. Magnetic actuator

Figure 4-20 Rotating Rectifier Assembly Hub and Components

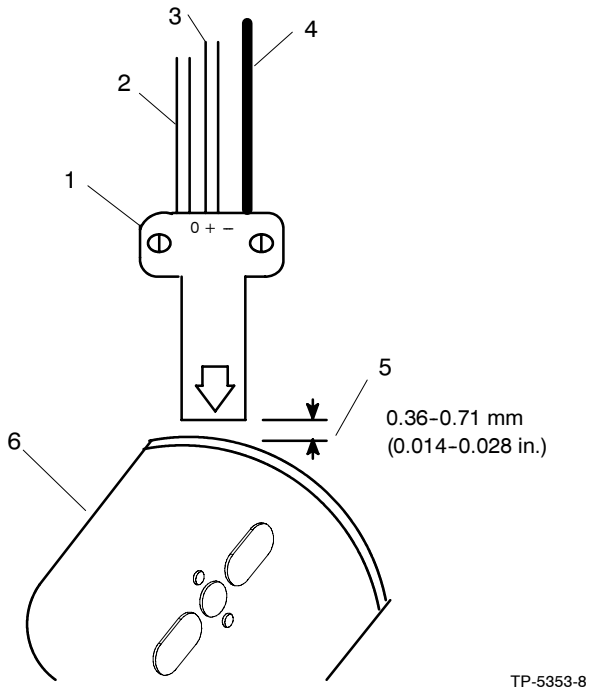
25. Reconnect the wiring to the three AC terminals and F+/F- terminals of the rotating rectifier assembly hub. See Figure 4-21. Torque to specifications.



1. AC terminal no. 1
2. AC terminal no. 2
3. AC terminal no. 3
4. Blue diode terminal no. 3 (connect to AC terminal no. 3)
5. Blue diode terminal no. 2 (connect to AC terminal no. 2)
6. Blue diode terminal no. 1 (connect to AC terminal no. 1)
7. Diode terminal (F-) (red) (connect to main field F-)
8. Diode terminal (F+) (blue) (connect to main field F+)
9. Varistor (connect to diode terminals F- and F+)
10. Red diode terminal no. 1 (connect to AC terminal no. 1)
11. Red diode terminal no. 2 (connect to AC terminal no. 2)
12. Red diode terminal no. 3 (connect to AC terminal no. 3)

Figure 4-21 Rotating Rectifier Assembly Hub Electrical Connections

26. Attach the speed sensor to the end bracket using two screws. Adjust the air gap. See Figure 4-22.



1. Speed sensor
2. Wire 16: white/clear
3. Wire 24: red
4. Wire 2: black
5. Air Gap: 0.36–0.71 mm (0.014–0.028 in.)
6. Magnetic actuator

Figure 4-22 Speed Sensor Air Gap

27. Replace the alternator (rodent) guard on the end bracket (if equipped).

28. Replace the rotating rectifier assembly housing.

29. Install the fan guard.

30. Reinstall the junction box and controller.

31. Reconnect all controller-to-engine and engine-to-alternator harnesses and wiring. Reconnect the speed sensor wiring. Refer to the respective wiring diagram manual as required.

32. Replace the junction box panels.

33. Reconnect the fuel, cooling, and exhaust systems that were disconnected during disassembly. Reconnect the output leads or load circuit cables at the alternator. Open the fuel supply valve.

34. Reconnect the starting batteries, negative lead last. Connect any AC-powered accessories such as the battery charger, block heater, fuel transfer pump, etc.

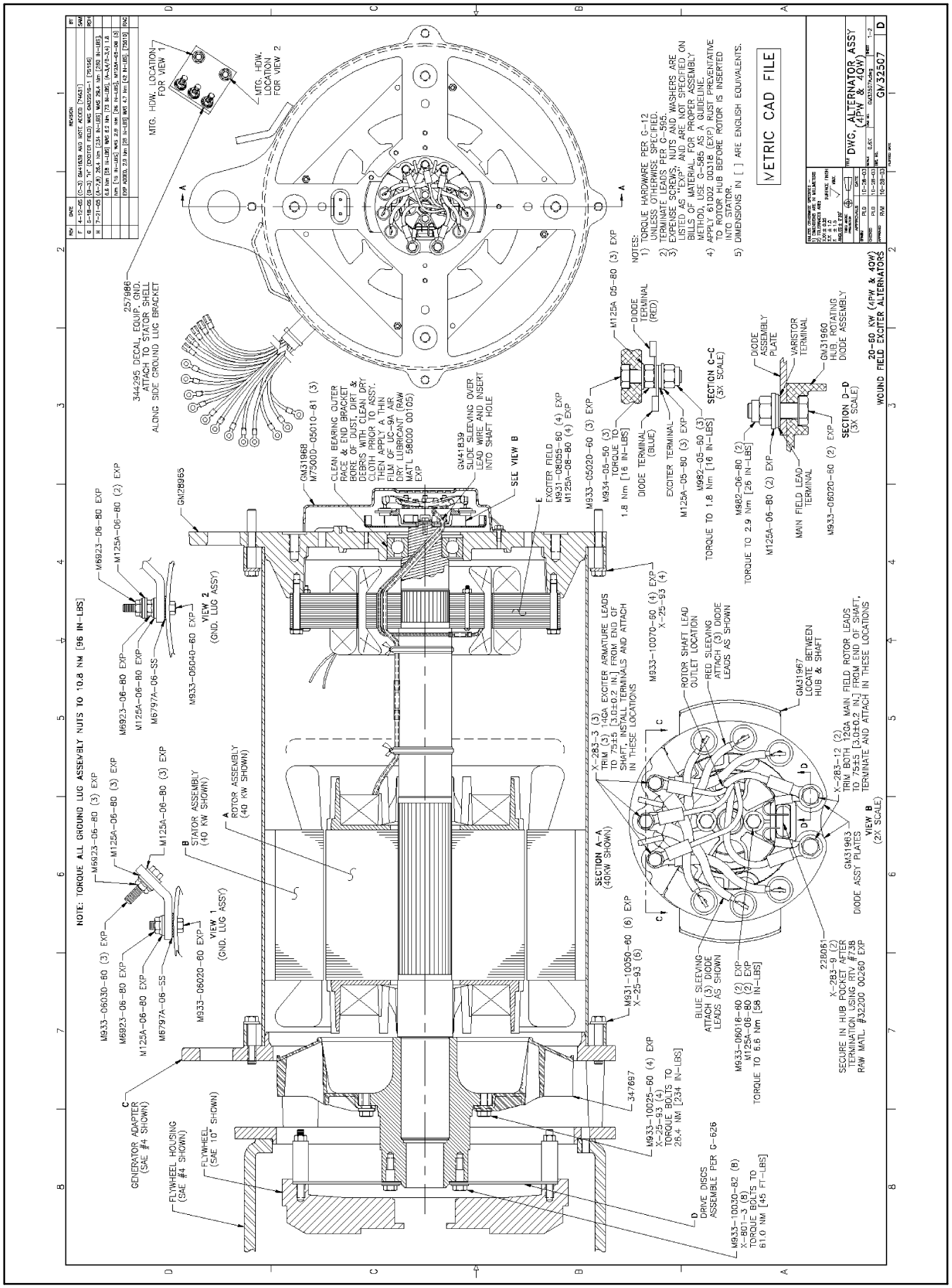

METRIC CAD FILE
NOTE: TORQUE ALL GROUND LUG ASSEMBLY NUTS TO 10.8 N·M [96 IN-LBS]
NOTES:
1) TORQUE HARDWARE PER G-12 UNLESS OTHERWISE SPECIFIED.
2) TERMINATE LEADS PER G-595.
3) EXPENSE SCREWS, NUTS AND WASHERS ARE LISTED AS 'EXP' AND ARE NOT SPECIFIED ON BILLS OF MATERIAL FOR PROPER ASSEMBLY METHOD, USE G-585 AS A GUIDELINE.
4) APPLY 2 OZ. (59 ML) OF 3M 08118 (EXP) RUST PREVENTATIVE TO ROTOR HUB BEFORE ROTOR IS INSERTED INTO STATOR.
5) DIMENSIONS IN [ ] ARE ENGLISH EQUIVALENTS.
20-60 KW (4PW & 4QW) WOUND FIELD EXCITER ALTERNATORS
DWG, ALTERNATOR ASSY (4PW & 4QW)
GM32507 D
MTG. HDW. LOCATION FOR VIEW 1
MTG. HDW. LOCATION FOR VIEW 2
257986 DECAL, EQUIP. GND. ATTACH TO STATOR SHELL ALONG SIDE GROUND LUG BRACKET
344295 DECAL, EQUIP. GND. ATTACH TO STATOR SHELL ALONG SIDE GROUND LUG BRACKET
VIEW 1 (GND. LUG ASSY)
VIEW 2 (GND. LUG ASSY)
GENERATOR ADAPTER (SAE #4 SHOWN)
FLYWHEEL HOUSING (SAE #4 SHOWN)
FLYWHEEL (SAE 10" SHOWN)
DRIVE DISCS ASSEMBLE PER G-626
STATOR ASSEMBLY (40 KW SHOWN)
ROTOR ASSEMBLY (40 KW SHOWN)
SECTION A-A (40KW SHOWN)
SECTION C-C (3X SCALE)
SECTION D-D (3X SCALE)
VIEW B (2X SCALE)
SEE VIEW B
EXCITER FIELD
DIODE TERMINAL (BLUE)
DIODE TERMINAL (RED)
EXCITER TERMINAL
DIODE ASSEMBLY PLATE
VARISTOR TERMINAL
MAIN FIELD LEAD TERMINAL
HUB, ROTATING DIODE ASSEMBLY
GM31960
GM31967 LOCATE BETWEEN HUB & SHAFT
GM31963 DIODE ASSY PLATES
GM31968 M75000-05010-81 (3)
GM41839 SLIDE SLEEVING OVER LEAD WIRE AND INSERT INTO SHAFT HOLE
GM28965
M6923-06-80 EXP
M125A-06-80 (2) EXP
M6797A-06-SS
M933-06040-60 EXP
M933-06030-60 (3) EXP
M125A-06-80 (3) EXP
M933-06020-60 EXP
M933-06016-60 (2) EXP
M125A-06-80 (2) EXP
M933-10030-82 (8)
X-801-3 (8)
TORQUE BOLTS TO 61.0 NM [45 FT-LBS]
M933-10025-60 (4) EXP
X-25-93 (4)
TORQUE BOLTS TO 26.4 NM [234 IN-LBS]
347697
M931-10050-60 (6) EXP
X-25-93 (6)
M933-10070-60 (4) EXP
X-25-93 (4)
M934-05-50 (3)
TORQUE TO 1.8 Nm [16 IN-LBS]
M982-05-60 (3)
TORQUE TO 1.8 Nm [16 IN-LBS]
M982-06-80 (2)
TORQUE TO 2.9 Nm [26 IN-LBS]
M933-06020-60 (2) EXP
M125A-05-80 (3) EXP
M125A-05-80 (3) EXP
M933-05020-60 (3) EXP
M931-08055-60 (4) EXP
M125A-08-80 (4) EXP
X-283-3 (3)
TRIM (3) 14GA EXCITER ARMATURE LEADS TO 75±5 [3.0±0.2 IN.] FROM END OF SHAFT, INSTALL TERMINALS AND ATTACH IN THESE LOCATIONS
ROTOR SHAFT LEAD OUTLET LOCATION
RED SLEEVING ATTACH (3) DIODE LEADS AS SHOWN
BLUE SLEEVING ATTACH (3) DIODE LEADS AS SHOWN
X-283-12 (2)
TRIM BOTH 12GA MAIN FIELD ROTOR LEADS TO 75±5 [3.0±0.2 IN.] FROM END OF SHAFT, TERMINATE AND ATTACH IN THESE LOCATIONS
228061
X-283-9 (2)
SECURE IN HUB POCKET AFTER TERMINATION USING RTV #738 RAW MATL. #32200 00260 EXP

Figure 4-23 4PW and 4QW Alternator Components, 20–60 kW

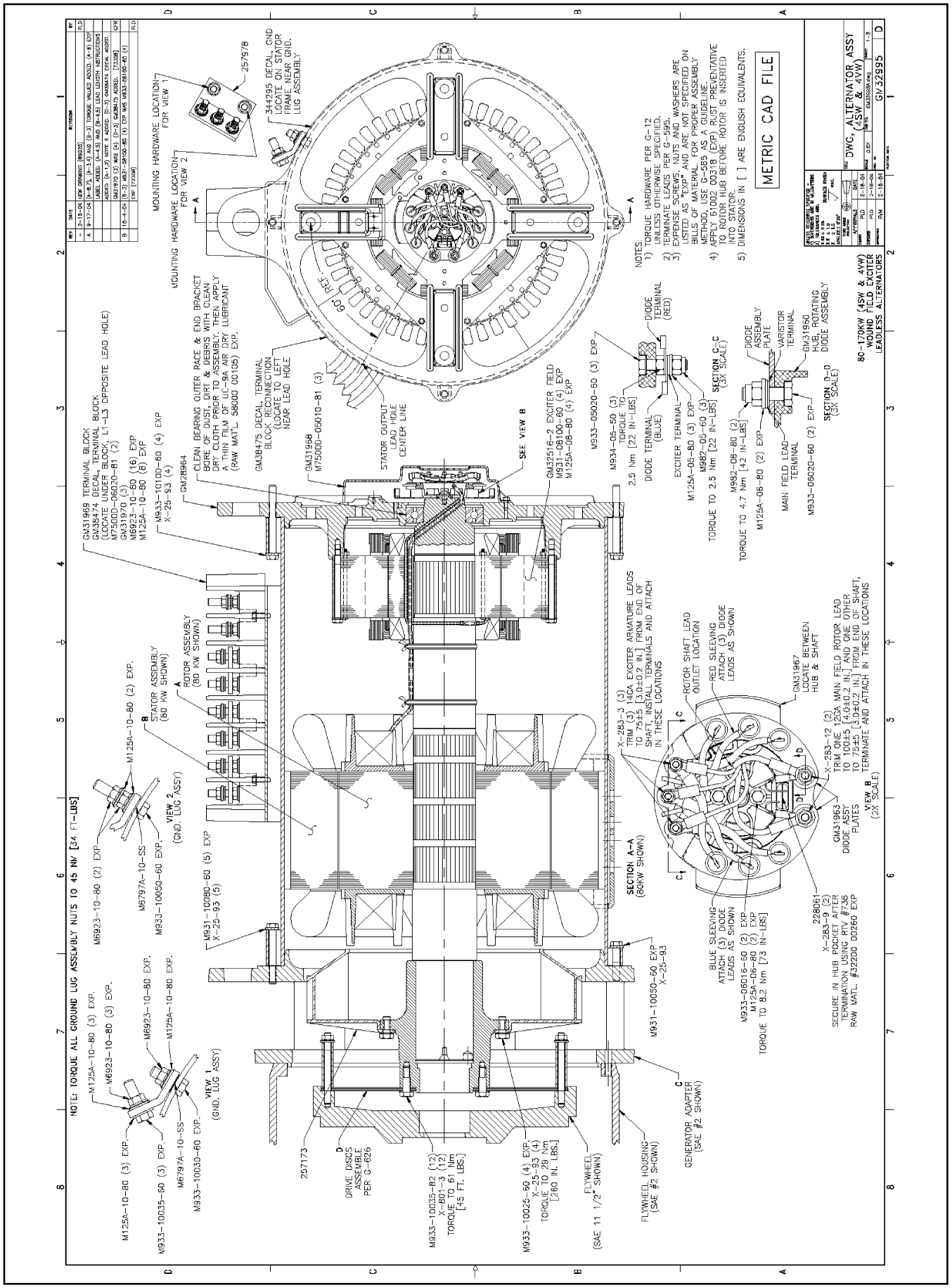

METRIC CAD FILE
DWG, ALTERNATOR ASSY (4SW & 4VW)
GM32995
80-170KW (4SW & 4VW) WOUND FIELD EXCITER LEADLESS ALTERNATORS
NOTES:
1) TORQUE HARDWARE PER G-12 UNLESS OTHERWISE SPECIFIED.
2) TERMINATE LEADS PER G-595.
3) EXPENSE SCREWS, NUTS AND WASHERS ARE LISTED AS "EXP" AND ARE NOT SPECIFIED ON BILLS OF MATERIAL FOR PROPER ASSEMBLY METHOD, USE G-585 AS A GUIDELINE.
4) APPLY 61002 00318 (EXP) RUST PREVENTATIVE TO ROTOR HUB BEFORE ROTOR IS INSERTED INTO STATOR.
5) DIMENSIONS IN [ ] ARE ENGLISH EQUIVALENTS.
NOTE: TORQUE ALL GROUND LUG ASSEMBLY NUTS TO 45 NM [34 FT-LBS]
MOUNTING HARDWARE LOCATION FOR VIEW 1
MOUNTING HARDWARE LOCATION FOR VIEW 2
SEE VIEW B
SECTION A-A (80KW SHOWN)
SECTION C-C (3X SCALE)
SECTION D-D (3X SCALE)
VIEW 1 (GND. LUG ASSY)
VIEW 2 (GND. LUG ASSY)
VIEW B (2X SCALE)
GM31969 TERMINAL BLOCK
GM35474 DECAL, TERMINAL BLOCK (LOCATE UNDER BLOCK, L1-L3 OPPOSITE LEAD HOLE)
M7500D-06020-81 (2)
GM31970 (3)
M6923-10-80 (16) EXP
M125A-10-80 (8) EXP
M933-10100-60 (4) EXP
X-25-93 (4)
GM28964
CLEAN BEARING OUTER RACE & END BRACKET BORE OF DUST, DIRT & DEBRIS WITH CLEAN DRY CLOTH PRIOR TO ASSEMBLY, THEN APPLY A THIN FILM OF LIC-9A AIR DRY LUBRICANT (RAW MAT'L. 58000 00105) EXP.
GM38475 DECAL, TERMINAL BLOCK RECONNECTION LOCATE TO LEFT NEAR LEAD HOLE
GM31968 M7500D-05010-81 (3)
STATOR OUTPUT LEAD HOLE CENTER LINE
GM32516-2 EXCITER FIELD M931-08100-60 (4) EXP M125A-08-80 (4) EXP
M933-05020-60 (3) EXP
M934-05-50 (3) TORQUE TO 2.5 Nm [22 IN-LBS]
DIODE TERMINAL (RED)
DIODE TERMINAL (BLUE)
EXCITER TERMINAL
M125A-05-80 (3) EXP
M982-05-60 (3) TORQUE TO 2.5 Nm [22 IN-LBS]
M982-06-80 (2) TORQUE TO 4.7 Nm [42 IN-LBS]
M125A-06-80 (2) EXP
DIODE ASSEMBLY PLATE
VARISTOR TERMINAL
MAIN FIELD LEAD
GM31960 HUB, ROTATING DIODE ASSEMBLY
M933-06020-60 (2) EXP
ROTOR ASSEMBLY (80 KW SHOWN)
STATOR ASSEMBLY (80 KW SHOWN)
M125A-10-80 (2) EXP.
M6923-10-80 (2) EXP
M6797A-10-SS
M933-10050-60 EXP.
M931-10080-60 (5) EXP
X-25-93 (5)
M125A-10-80 (3) EXP.
M6923-10-80 (3) EXP.
M6797A-10-SS
M933-10030-60 EXP.
257173
DRIVE DISCS ASSEMBLE PER G-626
M933-10035-82 (12) X-801-3 (12) TORQUE TO 61 Nm [45 FT. LBS.]
M933-10025-60 (4) EXP. X-25-93 (4) TORQUE TO 29 Nm [260 IN. LBS.]
FLYWHEEL (SAE 11 1/2" SHOWN)
FLYWHEEL HOUSING (SAE #2 SHOWN)
GENERATOR ADAPTER (SAE #2 SHOWN)
M931-10050-60 EXP X-25-93
X-283-3 (3) TRIM (3) 14GA EXCITER ARMATURE LEADS TO 75±5 [3.0±0.2 IN.] FROM END OF SHAFT, INSTALL TERMINALS AND ATTACH IN THESE LOCATIONS
ROTOR SHAFT LEAD OUTLET LOCATION
RED SLEEVING ATTACH (3) DIODE LEADS AS SHOWN
GM31967 LOCATE BETWEEN HUB & SHAFT
X-283-12 (2) TRIM ONE 12GA MAIN FIELD ROTOR LEAD TO 100±5 [4.0±0.2 IN.] AND ONE OTHER TO 75±5 [3.0±0.2 IN.] FROM END OF SHAFT, TERMINATE AND ATTACH IN THESE LOCATIONS
GM31963 DIODE ASSY PLATES
228061 X-283-9 (2) SECURE IN HUB POCKET AFTER TERMINATION USING RTV #738 RAW MAT'L. #32200 00269 EXP
BLUE SLEEVING ATTACH (3) DIODE LEADS AS SHOWN
M933-06016-60 (2) EXP M125A-06-80 (2) EXP TORQUE TO 8.2 Nm [73 IN-LBS]
257978
344295 DECAL, GND LOCATE ON STATOR FRAME NEAR GND. LUG ASSEMBLY
60° REF.

Figure 4-24 4SW and 4VW Alternator Components, 60 kW IMS–170 kW

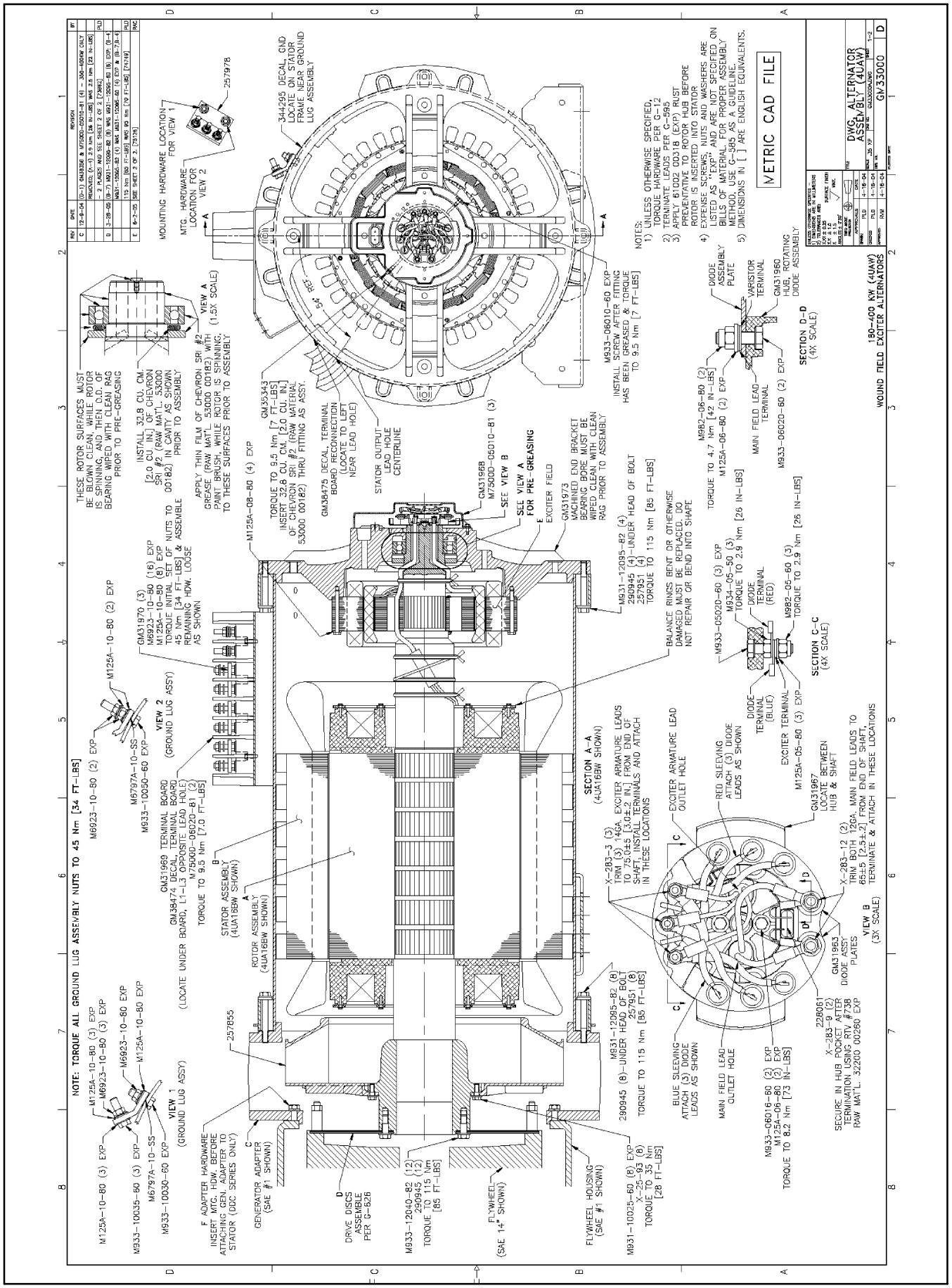

METRIC CAD FILE
DWG. ALTERNATOR ASSEMBLY (4UAW)
GM33000 D
180-400 KW (4UAW) WOUND FIELD EXCITER ALTERNATORS
NOTES:
1) UNLESS OTHERWISE SPECIFIED, TORQUE HARDWARE PER G-12
2) TERMINATE LEADS PER G-595
3) APPLY 61002 00318 (EXP) RUST PREVENTATIVE TO ROTOR HUB BEFORE ROTOR IS INSERTED INTO STATOR
4) EXPENSE SCREWS, NUTS AND WASHERS ARE LISTED AS "EXP" AND ARE NOT SPECIFIED ON BILLS OF MATERIAL FOR PROPER ASSEMBLY METHOD, USE G-585 AS A GUIDELINE.
5) DIMENSIONS IN [ ] ARE ENGLISH EQUIVALENTS.
NOTE: TORQUE ALL GROUND LUG ASSEMBLY NUTS TO 45 Nm [34 FT-LBS]
SECTION A-A (4UA16BW SHOWN)
SECTION C-C (4X SCALE)
SECTION D-D (4X SCALE)
VIEW A (1.5X SCALE)
VIEW B (3X SCALE)
VIEW 1 (GROUND LUG ASSY)
VIEW 2 (GROUND LUG ASSY)
ROTOR ASSEMBLY (4UA16BW SHOWN)
STATOR ASSEMBLY (4UA18BW SHOWN)
GENERATOR ADAPTER (SAE #1 SHOWN)
FLYWHEEL HOUSING (SAE #1 SHOWN)
FLYWHEEL (SAE 14" SHOWN)
DRIVE DISCS ASSEMBLE PER G-626
DIODE ASSEMBLY PLATE
HUB, ROTATING DIODE ASSEMBLY
EXCITER FIELD
SEE VIEW B
SEE VIEW A FOR PRE-GREASING
STATOR OUTPUT LEAD HOLE CENTERLINE
EXCITER ARMATURE LEAD OUTLET HOLE
MAIN FIELD LEAD OUTLET HOLE
BLUE SLEEVING ATTACH (3) DIODE LEADS AS SHOWN
RED SLEEVING ATTACH (3) DIODE LEADS AS SHOWN
MOUNTING HARDWARE LOCATION FOR VIEW 1
MTG. HARDWARE LOCATION FOR VIEW 2
344295 DECAL, GND LOCATE ON STATOR FRAME NEAR GROUND LUG ASSEMBLY
THESE ROTOR SURFACES MUST BE CLEAN. CLEAN WHEN ROTOR IS SPINNING, AND THEN C.O.D. OF BEARING WIPED WITH CLEAN RAG PRIOR TO PRE-GREASING
INSTALL 32.8 CU. CM. [2.0 CU. IN.] OF CHEVRON SRI #2 (RAW MATL. 53000 00182) IN CAVITY AS SHOWN PRIOR TO ASSEMBLY
APPLY THIN FILM OF CHEVRON SRI #2 GREASE (RAW MATL. 53000 00182) WITH PAINT BRUSH WHILE ROTOR IS SPINNING. TO THESE SURFACES PRIOR TO ASSEMBLY
M933-06010-60 EXP INSTALL SCREW AFTER FITTING HAS BEEN GREASED & TORQUE TO 9.5 Nm [7 FT-LBS]
M982-06-80 (2) M125A-06-80 (2) EXP TORQUE TO 4.7 Nm [42 IN-LBS]
M933-06020-60 (2) EXP MAIN FIELD LEAD TERMINAL
GM31960 VARISTOR TERMINAL
M933-05020-60 (3) EXP M934-05-50 (3) TORQUE TO 2.9 Nm [26 IN-LBS]
DIODE TERMINAL (RED)
M982-05-60 (3) TORQUE TO 2.9 Nm [26 IN-LBS]
DIODE TERMINAL (BLUE)
EXCITER TERMINAL
M125A-05-80 (3) EXP
M931-12095-82 (4) 290945 (4) UNDER HEAD OF BOLT 25795 TORQUE TO 115 Nm [85 FT-LBS]
BALANCE RINGS BENT OR OTHERWISE DAMAGED MUST BE REPLACED. DO NOT REPAIR OR BEND INTO SHAPE
GM31973 MACHINED END BRACKET BEARING BORE MUST BE WIPED CLEAN WITH CLEAN RAG PRIOR TO ASSEMBLY
GM31967 LOCATE BETWEEN HUB & SHAFT
X-283-3 (3) TRIM (3) 14GA EXCITER ARMATURE LEADS TO 75.0±5 [3.0±.2 IN.] FROM END OF SHAFT, INSTALL TERMINALS AND ATTACH IN THESE LOCATIONS
X-283-12 (2) TRIM BOTH 12GA. MAIN FIELD LEADS TO 65±5 [2.5±.2] FROM END OF SHAFT, TERMINATE & ATTACH IN THESE LOCATIONS
GM31963 DIODE ASSY PLATES
228061 X-283-4 (12) SECURE IN HUB POCKET AFTER TERMINATION USING #738 RAW MATL. 32200 00286 EXP
M933-06016-60 (2) EXP M125A-06-80 (2) EXP TORQUE TO 8.2 Nm [73 IN-LBS]
M931-12085-82 (8) 290945 (8) UNDER HEAD OF BOLT 25795 (8) TORQUE TO 115 Nm [85 FT-LBS]
M931-10025-60 (8) EXP X-25-93 (8) TORQUE TO 35 Nm [26 FT-LBS]
M933-12040-82 (12) 290945 (12) TORQUE TO 115 Nm [85 FT-LBS]
M933-10035-60 (3) EXP M6797A-10-SS M933-10030-60 EXP M125A-10-80 EXP M6923-10-80 (3) EXP M125A-10-80 (3) EXP
F ADAPTER HARDWARE INSERT MTG. HDW. BEFORE ATTACHING GEN. ADAPTER TO STATOR (DDC SERIES ONLY)
257855
M6923-10-80 (2) EXP M125A-10-80 (2) EXP M6797A-10-SS M933-10050-60 EXP
GM31969 TERMINAL BOARD GM38474 DECAL, TERMINAL BOARD (LOCATE UNDER BOARD, L1-L3 OPPOSITE LEAD HOLE) M75000-06020-81 (2) TORQUE TO 9.5 Nm [7.0 FT-LBS]
GM31970 (3) M6923-10-80 (6) EXP M125A-10-80 (6) EXP TORQUE INITIAL SET OF NUTS TO 45 Nm [34 FT-LBS] & REMAINING HDW. LOOSE AS SHOWN
M125A-08-80 (4) EXP
GM38475 DECAL, TERMINAL BOARD RECONNECTION (LOCATE TO LEFT NEAR LEAD HOLE)
GM35343 TORQUE TO 9.5 Nm [7 FT-LBS] INSERT 32.8 CU. CM. [2.0 CU. IN.] OF CHEVRON SRI #2 (RAW MATERIAL 53000 00182) THRU FITTING AS ASSY.
GM31968 M75000-06010-81 (3)

Figure 4-25 4UAW Alternator Components, 180–300 kW

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere
ABDC	after bottom dead center
AC	alternating current
A/D	analog to digital
ADC	advanced digital control; analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
Ah	amp-hour
AHWT	anticipatory high water temperature
AISI	American Iron and Steel Institute
ALOP	anticipatory low oil pressure
alt.	alternator
Al	aluminum
ANSI	American National Standards Institute (formerly American Standards Association, ASA)
AO	anticipatory only
APDC	Air Pollution Control District
API	American Petroleum Institute
approx.	approximate, approximately
AQMD	Air Quality Management District
AR	as required, as requested
AS	as supplied, as stated, as suggested
ASE	American Society of Engineers
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
auto.	automatic
aux.	auxiliary
avg.	average
AVR	automatic voltage regulator
AWG	American Wire Gauge
AWM	appliance wiring material
bat.	battery
BBDC	before bottom dead center
BC	battery charger, battery charging
BCA	battery charging alternator
BCI	Battery Council International
BDC	before dead center
BHP	brake horsepower
blk.	black (paint color), block (engine)
blk. htr.	block heater
BMEP	brake mean effective pressure
bps	bits per second
br.	brass
BTDC	before top dead center
Btu	British thermal unit
Btu/min.	British thermal units per minute
C	Celsius, centigrade
cal.	calorie
CAN	controller area network
CARB	California Air Resources Board
CB	circuit breaker
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
cert.	certificate, certification, certified
cfh	cubic feet per hour
cfm	cubic feet per minute
CG	center of gravity
CID	cubic inch displacement
CL	centerline
cm	centimeter
CMOS	complementary metal oxide substrate (semiconductor)
cogen.	cogeneration
com	communications (port)
coml	commercial
Coml/Rec	Commercial/Recreational
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cUL	Canadian Underwriter's Laboratories
CUL	Canadian Underwriter's Laboratories
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dB(A)	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
DFMEA	Design Failure Mode and Effects Analysis
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E, emer.	emergency (power source)
ECM	electronic control module, engine control module
EDI	electronic data interchange
EFR	emergency frequency relay
e.g.	for example (*exempli gratia)*
EG	electronic governor
EGSA	Electrical Generating Systems Association
EIA	Electronic Industries Association
EI/EO	end inlet/end outlet
EMI	electromagnetic interference
emiss.	emission
eng.	engine
EPA	Environmental Protection Agency
EPS	emergency power system
ER	emergency relay
ES	engineering special, engineered special
ESD	electrostatic discharge
est.	estimated
E-Stop	emergency stop
etc.	et cetera (and so forth)
exh.	exhaust
ext.	external
F	Fahrenheit, female
fglass.	fiberglass
FHM	flat head machine (screw)
fl. oz.	fluid ounce
flex.	flexible
freq.	frequency
FS	full scale
ft.	foot, feet
ft. lb.	foot pounds (torque)
ft./min.	feet per minute
ftp	file transfer protocol
g	gram
ga.	gauge (meters, wire size)
gal.	gallon
gen.	generator
genset	generator set
GFI	ground fault interrupter
GND, ⏚	ground
gov.	governor
gph	gallons per hour
gpm	gallons per minute
gr.	grade, gross
GRD	equipment ground
gr. wt.	gross weight
H x W x D	height by width by depth
HC	hex cap
HCHT	high cylinder head temperature
HD	heavy duty
HET	high exhaust temp., high engine temp.
hex	hexagon
Hg	mercury (element)
HH	hex head
HHC	hex head cap
HP	horsepower
hr.	hour
HS	heat shrink
hsg.	housing
HVAC	heating, ventilation, and air conditioning
HWT	high water temperature
Hz	hertz (cycles per second)
IC	integrated circuit
ID	inside diameter, identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMS	improved motor starting
in.	inch
in. H_2O	inches of water
in. Hg	inches of mercury
in. lb.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	iron pipe
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard

k	kilo (1000)
K	kelvin
kA	kiloampere
KB	kilobyte (2^{10} bytes)
KBus	Kohler communication protocol
kg	kilogram
kg/cm^2	kilograms per square centimeter
kgm	kilogram-meter
kg/m^3	kilograms per cubic meter
kHz	kilohertz
kJ	kilojoule
km	kilometer
kOhm, kΩ	kilo-ohm
kPa	kilopascal
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt ampere
kVAR	kilovolt ampere reactive
kW	kilowatt
kWh	kilowatt-hour
kWm	kilowatt mechanical
kWth	kilowatt-thermal
L	liter
LAN	local area network
L x W x H	length by width by height
lb.	pound, pounds
lbm/ft^3	pounds mass per cubic feet
LCB	line circuit breaker
LCD	liquid crystal display
ld. shd.	load shed
LED	light emitting diode
Lph	liters per hour
Lpm	liters per minute
LOP	low oil pressure
LP	liquefied petroleum
LPG	liquefied petroleum gas
LS	left side
L_{wa}	sound power level, A weighted
LWL	low water level
LWT	low water temperature
m	meter, milli (1/1000)
M	mega (10^6 when used with SI units), male
m^3	cubic meter
m^3/hr.	cubic meters per hour
m^3/min.	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCCB	molded-case circuit breaker
MCM	one thousand circular mils
meggar	megohmmeter
MHz	megahertz
mi.	mile
mil	one one-thousandth of an inch
min.	minimum, minute
misc.	miscellaneous
MJ	megajoule
mJ	millijoule
mm	millimeter
mOhm, mΩ	milliohm
MOhm, MΩ	megohm
MOV	metal oxide varistor
MPa	megapascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
ms	millisecond
m/sec.	meters per second
MTBF	mean time between failure
MTBO	mean time between overhauls
mtg.	mounting
MTU	Motoren-und Turbinen-Union
MW	megawatt
mW	milliwatt
µF	microfarad
N, norm.	normal (power source)
NA	not available, not applicable
nat. gas	natural gas
NBS	National Bureau of Standards
NC	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	newton meter
NO	normally open
no., nos.	number, numbers
NPS	National Pipe, Straight
NPSC	National Pipe, Straight-coupling
NPT	National Standard taper pipe thread per general use
NPTF	National Pipe, Taper-Fine
NR	not required, normal relay
ns	nanosecond
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OF	overfrequency
opt.	option, optional
OS	oversize, overspeed
OSHA	Occupational Safety and Health Administration
OV	overvoltage
oz.	ounce
p., pp.	page, pages
PC	personal computer
PCB	printed circuit board
pF	picofarad
PF	power factor
ph., ∅	phase
PHC	Phillips® head Crimptite® (screw)
PHH	Phillips® hex head (screw)
PHM	pan head machine (screw)
PLC	programmable logic control
PMG	permanent magnet generator
pot	potentiometer, potential
ppm	parts per million
PROM	programmable read-only memory
psi	pounds per square inch
psig	pounds per square inch gauge
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart, quarts
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
Res/Coml	Residential/Commercial
RFI	radio frequency interference
RH	round head
RHM	round head machine (screw)
rly.	relay
rms	root mean square
rnd.	round
ROM	read only memory
rot.	rotate, rotating
rpm	revolutions per minute
RS	right side
RTU	remote terminal unit
RTV	room temperature vulcanization
RW	read/write
SAE	Society of Automotive Engineers
scfm	standard cubic feet per minute
SCR	silicon controlled rectifier
s, sec.	second
SI	*Systeme international d'unites,* International System of Units
SI/EO	side in/end out
sil.	silencer
SN	serial number
SNMP	simple network management protocol
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec	specification
specs	specification(s)
sq.	square
sq. cm	square centimeter
sq. in.	square inch
SS	stainless steel
std.	standard
stl.	steel
tach.	tachometer
TD	time delay
TDC	top dead center
TDEC	time delay engine cooldown
TDEN	time delay emergency to normal
TDES	time delay engine start
TDNE	time delay normal to emergency
TDOE	time delay off to emergency
TDON	time delay off to normal
temp.	temperature
term.	terminal
THD	total harmonic distortion
TIF	telephone influence factor
TIR	total indicator reading
tol.	tolerance
turbo.	turbocharger
typ.	typical (same in multiple locations)
UF	underfrequency
UHF	ultrahigh frequency
UL	Underwriter's Laboratories, Inc.
UNC	unified coarse thread (was NC)
UNF	unified fine thread (was NF)
univ.	universal
US	undersize, underspeed
UV	ultraviolet, undervoltage
V	volt
VAC	volts alternating current
VAR	voltampere reactive
VDC	volts direct current
VFD	vacuum fluorescent display
VGA	video graphics adapter
VHF	very high frequency
W	watt
WCR	withstand and closing rating
w/	with
w/o	without
wt.	weight
xfmr	transformer

Appendix B Common Hardware Application Guidelines

Use the information below and on the following pages to identify proper fastening techniques when no specific reference for reassembly is made.

Bolt/Screw Length: When bolt/screw length is not given, use Figure 1 as a guide. As a general rule, a minimum length of one thread beyond the nut and a maximum length of 1/2 the bolt/screw diameter beyond the nut is the preferred method.

Washers and Nuts: Use split lock washers as a bolt locking device where specified. Use SAE flat washers with whiz nuts, spiralock nuts, or standard nuts and preloading (torque) of the bolt in all other applications.

See Appendix C, General Torque Specifications, and other torque specifications in the service literature.

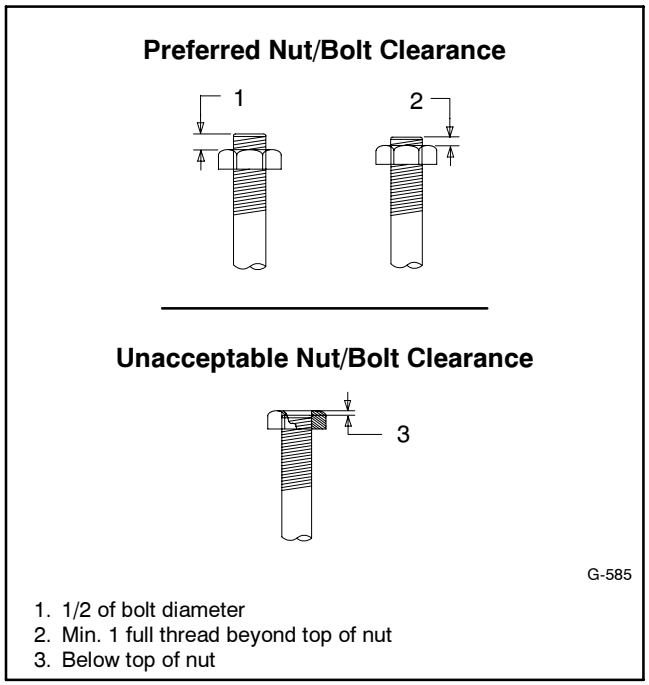


Figure 1 Acceptable Bolt Lengths

Steps for common hardware application:

1. Determine entry hole type: round or slotted.

2. Determine exit hole type: fixed female thread (weld nut), round, or slotted.

   For round and slotted exit holes, determine if hardware is greater than 1/2 inch in diameter, or 1/2 inch in diameter or less. Hardware that is *greater than 1/2 inch* in diameter takes a standard nut and SAE washer. Hardware *1/2 inch or less* in diameter can take a properly torqued whiz nut or spiralock nut. See Figure 2.

3. Follow these SAE washer rules after determining exit hole type:

   a. Always use a washer between hardware and a slot.

   b. Always use a washer under a nut (see 2 above for exception).

   c. Use a washer under a bolt when the female thread is fixed (weld nut).

4. Refer to Figure 2, which depicts the preceding hardware configuration possibilities.

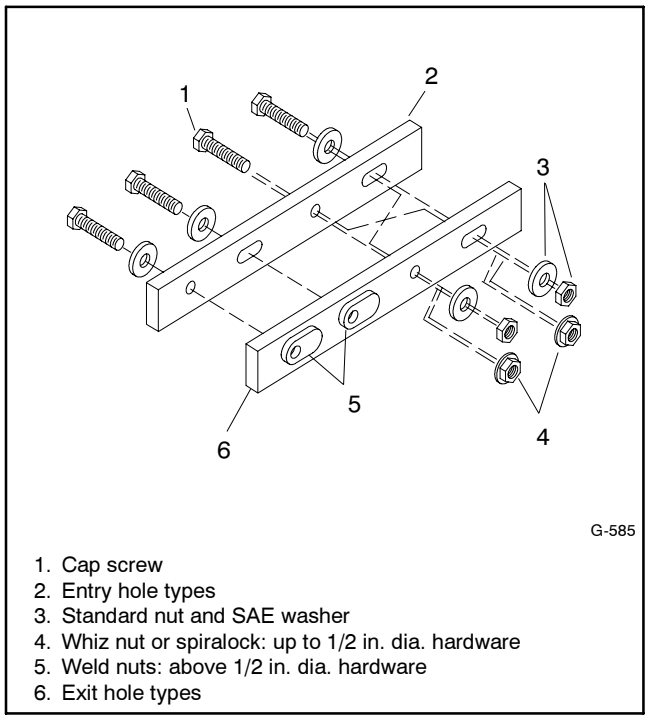


Figure 2 Acceptable Hardware Combinations

Appendix C General Torque Specifications

American Standard Fasteners Torque Specifications								
Size	Torque Measurement	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 2 or 5
		Grade 2		Grade 5		Grade 8		
8-32	Nm (in. lb.)	1.8	(16)	2.3	(20)	—		See Note 3
10-24	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
10-32	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
1/4-20	Nm (in. lb.)	6.8	(60)	10.8	(96)	14.9	(132)	
1/4-28	Nm (in. lb.)	8.1	(72)	12.2	(108)	16.3	(144)	
5/16-18	Nm (in. lb.)	13.6	(120)	21.7	(192)	29.8	(264)	
5/16-24	Nm (in. lb.)	14.9	(132)	23.1	(204)	32.5	(288)	
3/8-16	Nm (ft. lb.)	24.0	(18)	38.0	(28)	53.0	(39)	
3/8-24	Nm (ft. lb.)	27.0	(20)	42.0	(31)	60.0	(44)	
7/16-14	Nm (ft. lb.)	39.0	(29)	60.0	(44)	85.0	(63)	
7/16-20	Nm (ft. lb.)	43.0	(32)	68.0	(50)	95.0	(70)	
1/2-13	Nm (ft. lb.)	60.0	(44)	92.0	(68)	130.0	(96)	
1/2-20	Nm (ft. lb.)	66.0	(49)	103.0	(76)	146.0	(108)	
9/16-12	Nm (ft. lb.)	81.0	(60)	133.0	(98)	187.0	(138)	
9/16-18	Nm (ft. lb.)	91.0	(67)	148.0	(109)	209.0	(154)	
5/8-11	Nm (ft. lb.)	113.0	(83)	183.0	(135)	259.0	(191)	
5/8-18	Nm (ft. lb.)	128.0	(94)	208.0	(153)	293.0	(216)	
3/4-10	Nm (ft. lb.)	199.0	(147)	325.0	(240)	458.0	(338)	
3/4-16	Nm (ft. lb.)	222.0	(164)	363.0	(268)	513.0	(378)	
1-8	Nm (ft. lb.)	259.0	(191)	721.0	(532)	1109.0	(818)	
1-12	Nm (ft. lb.)	283.0	(209)	789.0	(582)	1214.0	(895)	

Metric Fasteners Torque Specifications, Measured in Nm (ft. lb.)								
Size (mm)	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 5.8 or 8.8
	Grade 5.8		Grade 8.8		Grade 10.9		
M6 x 1.00	6.2	(4.6)	9.5	(7)	13.6	(10)	See Note 3
M8 x 1.25	15.0	(11)	23.0	(17)	33.0	(24)	
M8 x 1.00	16.0	(11)	24.0	(18)	34.0	(25)	
M10 x 1.50	30.0	(22)	45.0	(34)	65.0	(48)	
M10 x 1.25	31.0	(23)	47.0	(35)	68.0	(50)	
M12 x 1.75	53.0	(39)	80.0	(59)	115.0	(85)	
M12 x 1.50	56.0	(41)	85.0	(63)	122.0	(90)	
M14 x 2.00	83.0	(61)	126.0	(93)	180.0	(133)	
M14 x 1.50	87.0	(64)	133.0	(98)	190.0	(140)	
M16 x 2.00	127.0	(94)	194.0	(143)	278.0	(205)	
M16 x 1.50	132.0	(97)	201.0	(148)	287.0	(212)	
M18 x 2.50	179.0	(132)	273.0	(201)	390.0	(288)	
M18 x 1.50	189.0	(140)	289.0	(213)	413.0	(305)	

Notes:

1. The torque values above are general guidelines. Always use the torque values specified in the service manuals and/or assembly drawings when they differ from the above torque values.
2. The torque values above are based on new plated threads. Increase torque values by 15% if non-plated threads are used.
3. Hardware threaded into aluminum must have either two diameters of thread engagement or a 30% or more reduction in the torque to prevent stripped threads.
4. Torque values are calculated as equivalent stress loading on American hardware with an approximate preload of 90% of the yield strength and a friction coefficient of 0.125.

Appendix D Common Hardware Identification

Screw/Bolts/Studs	
Head Styles	
Hex Head or Machine Head	
Hex Head or Machine Head with Washer	
Flat Head (FHM)	
Round Head (RHM)	
Pan Head	
Hex Socket Head Cap or Allen™ Head Cap	
Hex Socket Head or Allen™ Head Shoulder Bolt	
Sheet Metal Screw	
Stud	
Drive Styles	
Hex	
Hex and Slotted	
Phillips®	
Slotted	
Hex Socket	

Nuts	
Nut Styles	
Hex Head	
Lock or Elastic	
Square	
Cap or Acorn	
Wing	
Washers	
Washer Styles	
Plain	
Split Lock or Spring	
Spring or Wave	
External Tooth Lock	
Internal Tooth Lock	
Internal-External Tooth Lock	

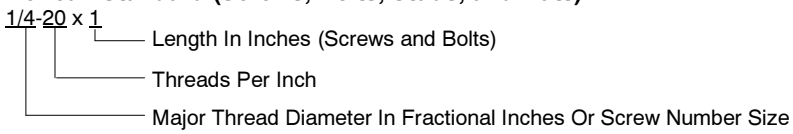
Hardness Grades	
American Standard	
Grade 2	
Grade 5	
Grade 8	
Grade 8/9 (Hex Socket Head)	
Metric	
Number stamped on hardware; 5.8 shown	

Allen™ head screw is a trademark of Holo-Krome Co.

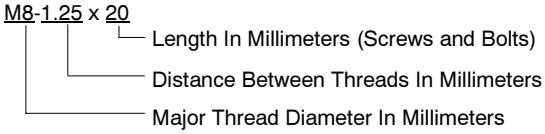
Phillips® screw is a registered trademark of Phillips Screw Company.

Sample Dimensions

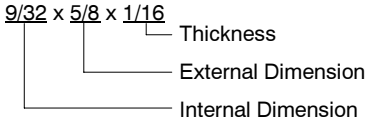
American Standard (Screws, Bolts, Studs, and Nuts)


1/4-20 x 1
Length In Inches (Screws and Bolts)
Threads Per Inch
Major Thread Diameter In Fractional Inches Or Screw Number Size

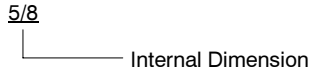
Metric (Screws, Bolts, Studs, and Nuts)


M8-1.25 x 20
Length In Millimeters (Screws and Bolts)
Distance Between Threads In Millimeters
Major Thread Diameter In Millimeters

Plain Washers



Lock Washers



Notes

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Singapore 619159
Phone (65) 6264-6422, Fax (65) 6264-6455

TP-6349 6/07b

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Service Parts

Engine

Engine Models:

John Deere 3029DF
3029TF
3029TF270

Generator Models:

20ROZJB
20–40REOZJB
20DSJB
20–40DSEJB

TP-6141 12/03b

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Introduction

This manual contains a list of service replacement parts for John Deere diesel-fueled 3029 series engines. Refer to the Specification Number Index for generator models and specifications covered.

This manual includes the following main sections:

- *Table of Contents:* Lists the sections of this catalog.

- *Introduction (and other information sections):* Contains introductory material followed by sections on specification numbers, part numbers, and hardware.

- *Index:* Indexes generator set specifications and their groups.

- *Group Parts Lists:* List part numbers of parts in the groups.

Number Significance

This catalog uses a variety of numbering systems. A description of these follows.

- *Group Number:* A group consists of parts needed to perform one or more related functions. For example, Group 1 is the Engine Air Intake group.

- *Variation Number:* A group might have several variations. Parts comprising each variation perform the same function, but parts lists vary. For example, a 50 Hz fuel injection pump and a 60 Hz fuel injection pump perform the same function. However, they are constructed of different parts. Each of these differences necessitates the assignment of a group variation number.

- *Part Number:* The part number identifies an individual assembly, subassembly, component, or accessory kit.

How to Find Part Numbers

Follow these steps to identify a part:

STEP 1: Turn to the Specification Number Index. The first column lists engine models grouped by generator set model. The headings across the top identify the groups of parts that make up the engine. The intersection of the engine model and the group numbers is the variation number corresponding to the components of that engine. Note the variation number.

STEP 2: Find the page number of the group in the Table of Contents and turn to that page or page forward until you find the group. Use the drawings and itemized text to locate the part and its part number.

Specification Number Index

Group Title	Air Intake	Water Pump	Thermostat	Fan Belt	Vent Tube	Camshaft	Valve Train	Rocker Arm Cover	Fuel Injection Pump	Fuel Injection Nozzle	Cylinder Block	Crankshaft	Crankshaft Pulley
Group No.	**1**	**2a**	**2b**	**2c**	**3**	**4a**	**4b**	**4c**	**5a**	**5b**	**7**	**8a**	**8b**
	Variation Number												
Engine Model													
3029DF, 60 Hz	1712	2020	2110	2401	2902	9914	9901	1105	1603	1603	9906	9919	1330
3029DF, 50 Hz	1712	2020	2110	2401	2902	9914	9901	1105	1641	1641	9906	9919	1330
3029TF, 60 Hz	1710A	2020	2110	2401	2902	9914	9901	1105	16TR	16TR	9906	9919	1330
3029TF, 50 Hz	1710A	2020	2110	2401	2902	9914	9901	1105	16TT	16TT	9906	9919	1330
3029TF270	1710B	2020	2110	2401	2902	4607	4903	1105	164H	164H	4607	4702	1330

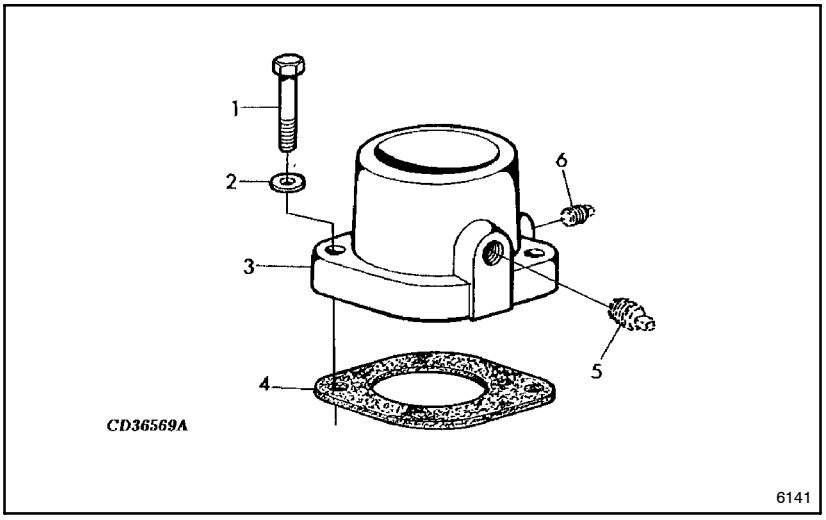
Group Title	Cylinder Head	Valves	Oil Filter & Dipstick	Starter Motor	Starter Motor Components	Exhaust Manifold	Flywheel	Flywheel Housing	Fuel Pump	Fuel Filter	Timing Gear Cover	Oil Pan	
Group No.	**9a**	**9b**	**10**	**11a**	**11b**	**12a**	**13a**	**13b**	**14**	**15**	**18**	**21a**	
	Variation Number												
Engine Model													
3029DF, 60 Hz	9902	9903	4004	3008	3008	2802D	1501	1418	3710	1	4499	1901	
3029DF, 50 Hz	9902	9903	4004	3008	3008	2802D	1501	1418	3710	1	4499	1901	
3029TF, 60 Hz	9902	9903	4006	3008	3008	2802T	1501	1418	3710	1	4499	1901	
3029TF, 50 Hz	9902	9903	4006	3008	3008	2802T	1501	1418	3710	1	4499	1901	
3029TF270	5105	5105	5939	3008	3008	2802T	1501	1453	3710	35DD	4499	1901	

Specification Number Index

Group TItle	Oil Fill Tube	Oil Cooler	Piston	Connecting Rod	Oil Pump	Front Plate	Cylinder Head Gasket Set	Overhaul Gasket Set	Short Block	Turbocharger & Oil Lines	Alternator	Alternator Brackets	Alternator Components
Group No.	**21b**	**21c**	**22a**	**22b**	**25**	**26**	**39a**	**39b**	**42**	**50**	**51a**	**51b**	**51c**
	Variation Number												
Engine Model													
3029DF, 60 Hz	1299	5906	9915	9916	9928	-	1	9932	9910	-	3123	6218	3123
3029DF, 50 Hz	1299	5906	9915	9916	9928	-	1	9932	9910	-	3123	6218	3123
3029TF, 60 Hz	1299	5906	9917	9918	9928	1	1	9932	9910	6547	3123	6218	3123
3029TF, 50 Hz	1299	5906	9917	9918	9928	-	1	9932	9910	65BS	3123	6218	3123
3029TF270	1299	5939	4814	4814	5001	3622	9706	9706	9702	6547	3123	6218	3123

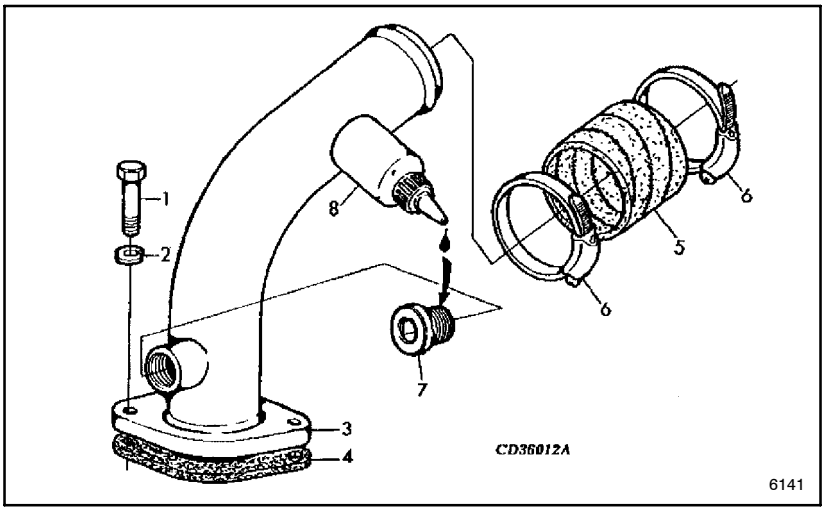
Notes

Group 1: Air Intake



Item	Part No.	Description	Qty. Var. 1712
1	222765	Screw, cap	2
2	#	Washer, 10.500 x 18 x 1.600 mm	2
3	GM21398	Intake, air	1
4	223532	Gasket	1
5	Not used		1
6	Not used		1

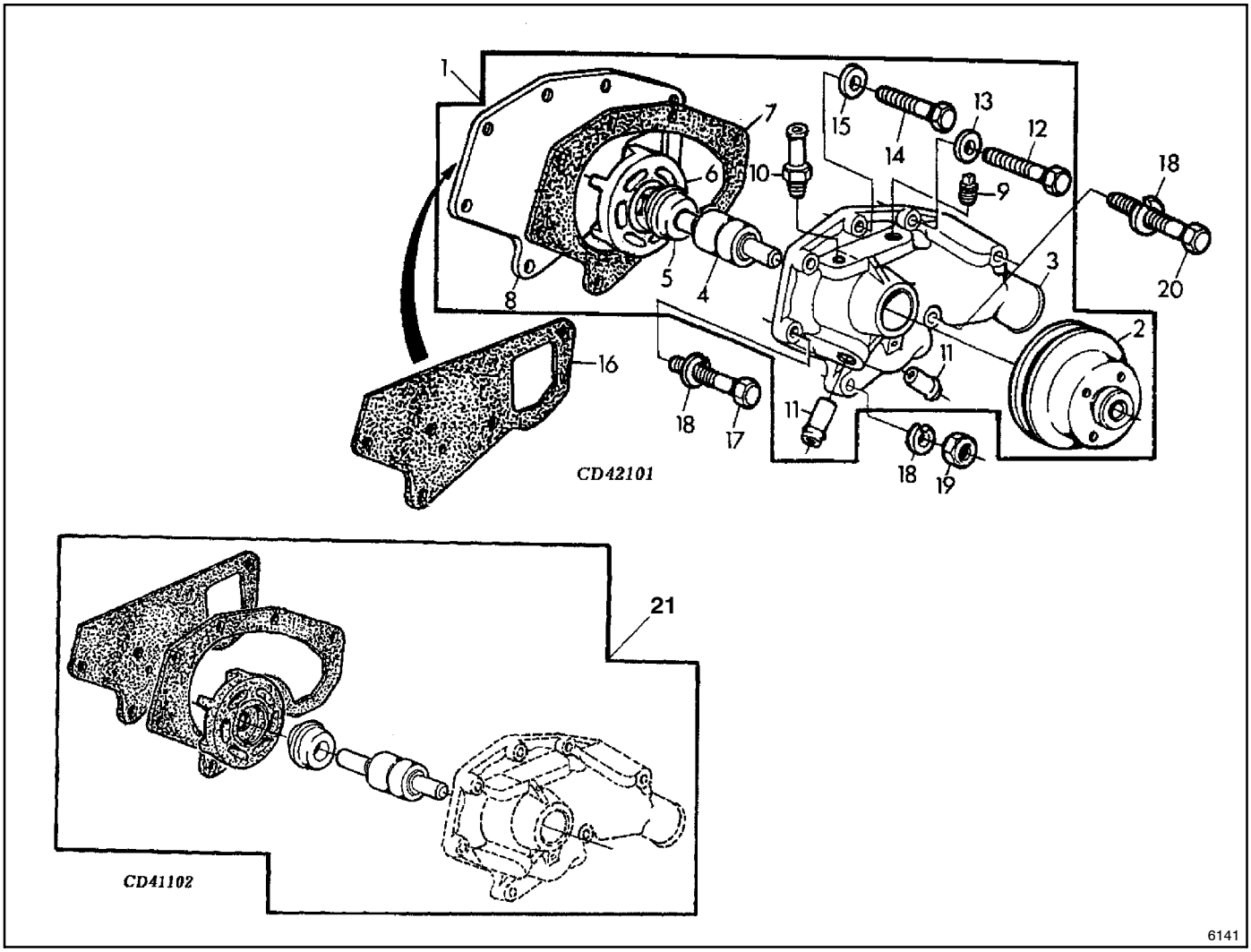
Common hardware; procure locally.



Item	Part No.	Description	Qty. Var. 1710A	Qty. Var. 1710B
1	#	Screw, cap, 3/8 x 1 1/8 in. (SAE grade 8)	2	2
2	#	Washer, lock, 3/8 in.	2	2
3	GM21399	Tube (also order items 7 and 8)	1	
3	GM32721	Duct, air		1
4	223532	Gasket	1	1
5	GM21400	Hose	1	1
6	336706	Clamp, hose	2	2
7	360174	Fitting	1	
8	#	Sealant, Loctite® 592	AR	

Common hardware; procure locally.
AR As Required
Loctite® is a registered trademark of Loctite Corporation.

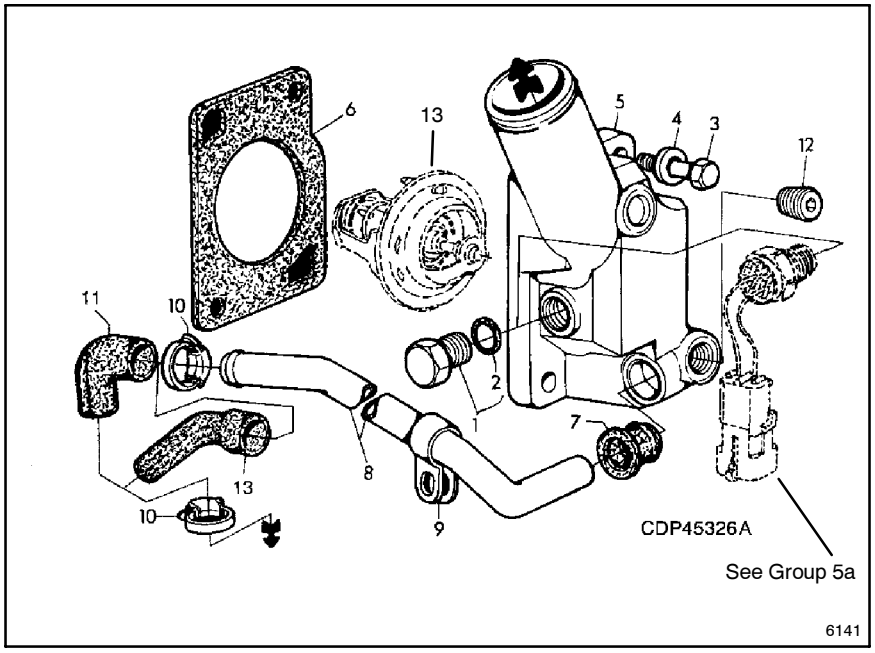
Group 2a: Water Pump



Item	Part No.	Description	Qty. Var. 2020
1	GM21401	Pump, water	1
2	223659	Pulley	1
3	X	Housing (order item 1)	1
4	X	Bearing, ball (order item 21)	1
5	X	Seal (order item 21)	1
6	223553	Impeller	1
7	223560	Gasket	1
8	GM21402	Cover	1
9	#	Plug, pipe, 1/2 in.-14 NPT	1
10	GM21403	Fitting, union, 1/4 in.-18 NPT x 54 mm	1
11	352067	Tube	2
12	#	Screw, cap, 3/8 in. x 1 1/2 in. (SAE grade 8)	1
13	#	Washer, 10 x 18 x 2.500 mm	1
14	#	Screw, cap, 3/8 in. x 1 3/8 in. (SAE grade 8)	1
15	#	Washer, 10.500 x 18 x 1.600 mm	1
16	223628	Gasket	1
17	#	Screw, cap, 3/8 in. x 2 in. (SAE grade 8)	1
18	#	Washer, locker, 3/8 in.	3
19	#	Nut, 3/8 in.	1
20	#	Screw, cap, 3/8 in. x 3 1/2 in.	2
21	GM21404	Kit, pump repair	1

Common hardware; procure locally.
X Not sold separately.

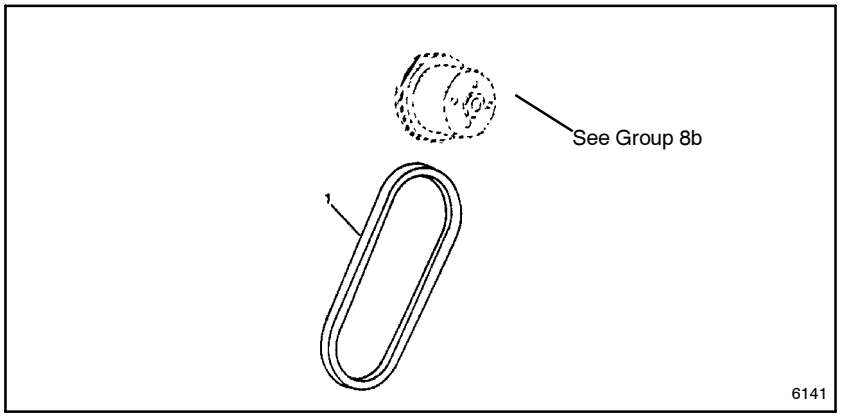
Group 2b: Thermostat



Item	Part No.	Description	Qty. Var. 2110
1	360013	Plug	1
2	GM21508	O-ring	1
3	#	Screw, cap, 3/8 in. x 1 1/8 in.	2
4	#	Washer, 10 x 18 x 2.500 mm	2
5	GM32722	Cover (also order items 1, 7, and 12)	1
6	GM21406	Gasket	1
7	360116	Gasket, water bypass tube	1
8	GM21407	Gasket	1
9	GM21408	Clamp	2
10	GM21409	Clamp	1
11	336463	Hose	1
12	GM15403	Plug, pipe	1
13	223595	Thermostat, 82 deg. C	1

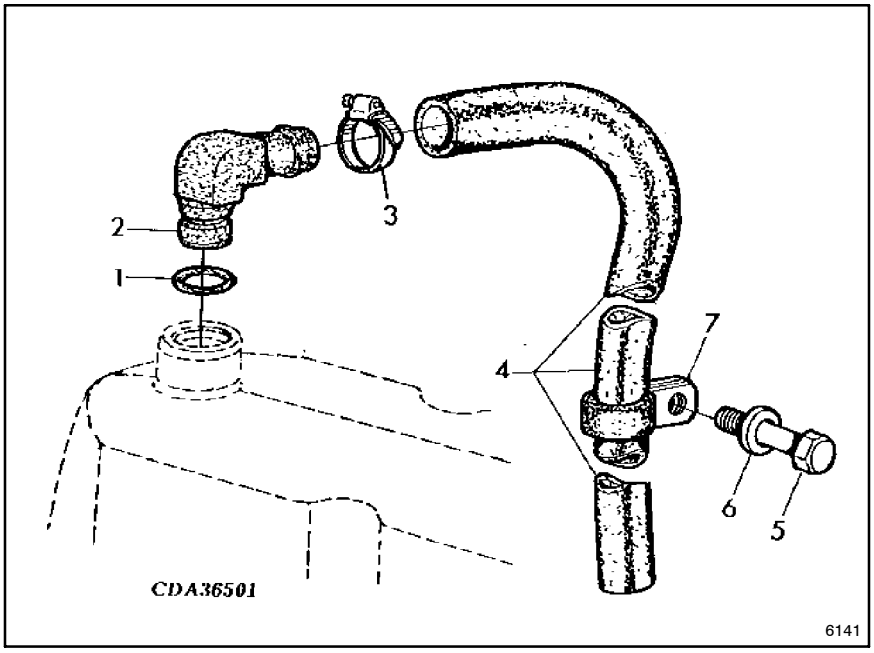
Common hardware; procure locally.

Group 2c: Fan Belt



Item	Part No.	Description	Qty. Var. 2401
1	GM11846	Belt, fan	1

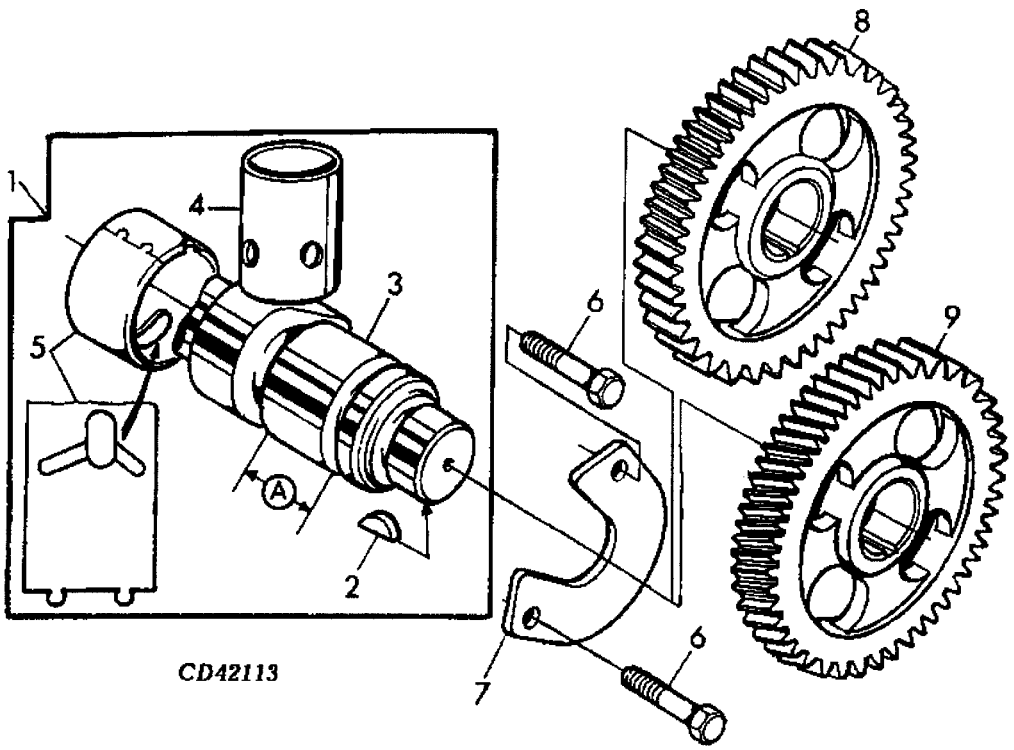
Group 3: Vent Tube



Item	Part No.	Description	Qty. Var. 2902
1	223491	O-ring	1
2	223551	Fitting, elbow	1
3	336475	Clamp	1
4	GM32723	Tube	1
5	#	Screw, 5/16 x 1/2 in.	1
6	#	Washer, 8.4 x 16 x 1.6 mm	1
7	GM32724	Clamp	1

Common hardware; procure locally.

Group 4a: Camshaft



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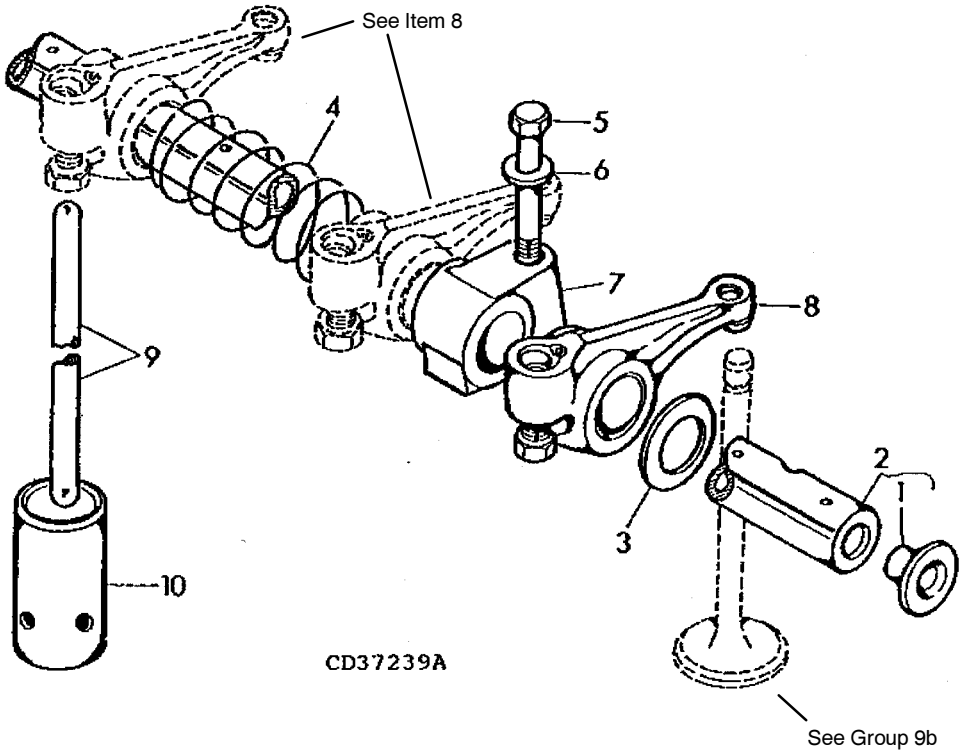
Item	Part No.	Description	Qty. Var. 9914	Qty. Var. 4607
1	GM21411	Camshaft kit	1	1
2	223407	Key, woodruff	1	1
3	X	Camshaft	1	1
4	223611	Tappet	8	8
5	352246	Bushing	1	1
6	#	Screw, cap, 3/8 in. x 1 in. (SAE grade 8)	2	2
7	223610	Plate	1	1
8	Not used	Gear, spur	1	1
9	223609	Gear	1	1

Common hardware; procure locally.
X Not sold separately.

Group 4b: Valve Train



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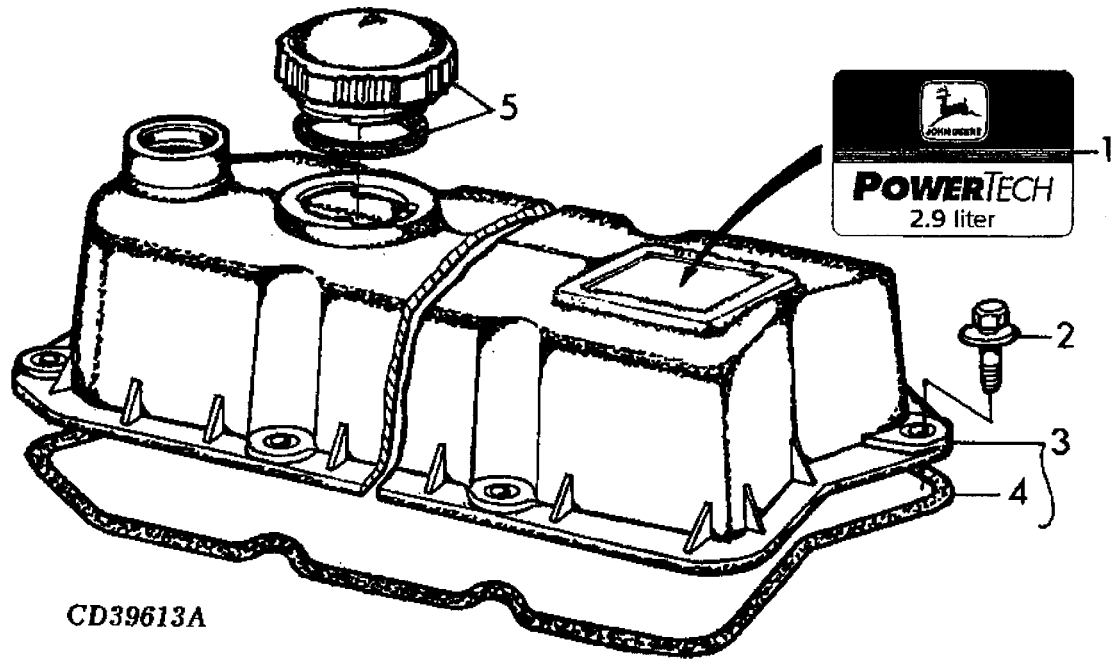
Item	Part No.	Description	Qty. Var. 4903	Qty. Var. 9901
1	223480	Plug	2	2
2	GM32725	Shaft, rocker arm	1	
2	GM21412	Shaft, rocker arm		1
3	223634	Washer	2	2
4	223632	Spring	2	2
5	GM32726	Screw, self locking	3	
5	#	Screw, cap, 3/8 in. x 2 1/2 in. (SAE grade 8)		3
6	223756	Washer		3
7	223633	Support		3
7	360112	Support	3	
8	223592	Arm, rocker	6	6
9	GM21413	Rod, push	6	6
10	223611	Tappet	6	6

Common hardware; procure locally.

Group 4c: Rocker Arm Cover



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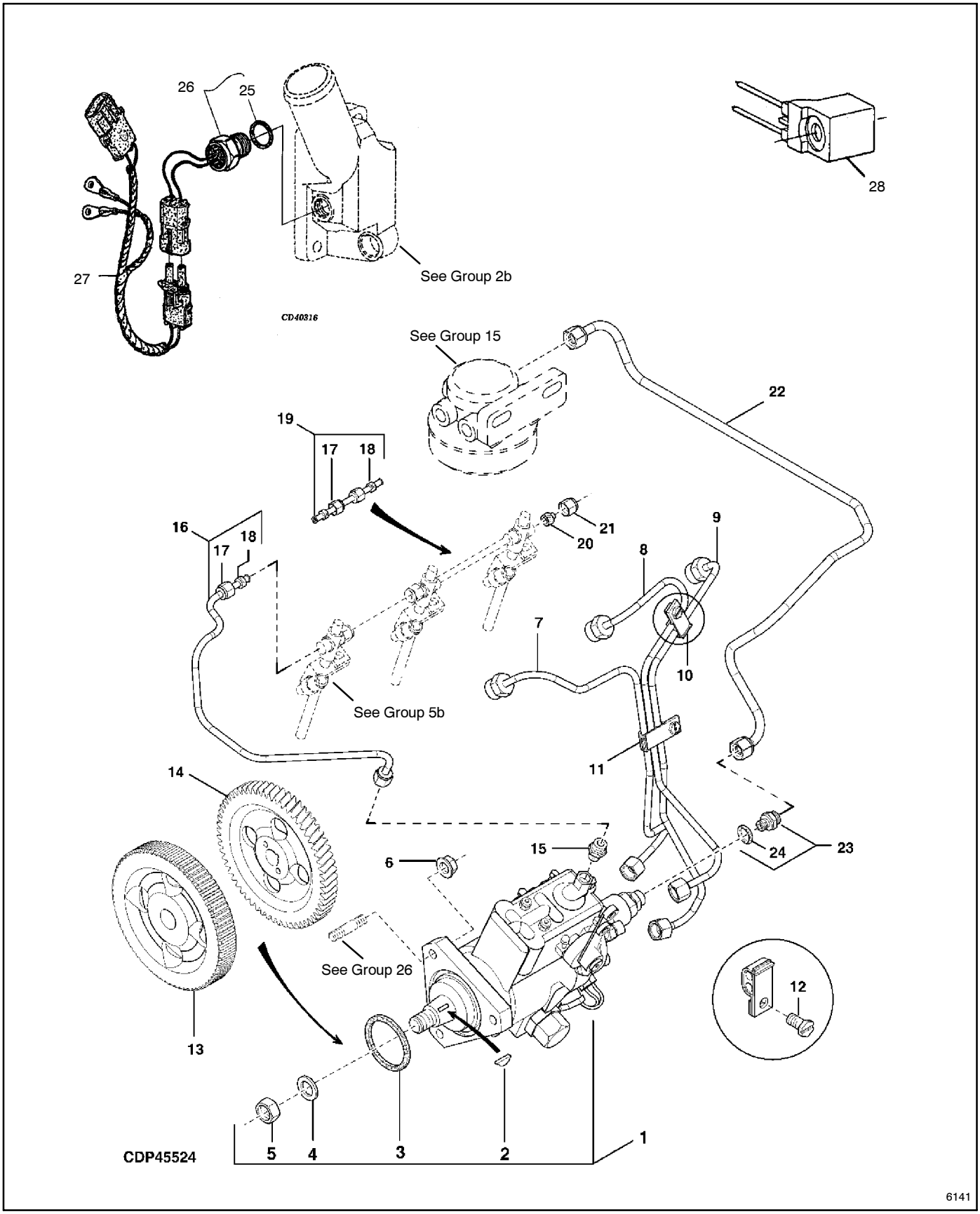
Item	Part No.	Description	Qty. Var. 1105
1	X	Label	1
2	GM21414	Screw with washer	6
3	GM21415	Cover, valve	1
4	GM21416	Gasket	1
5	336435	Cap, filler	1

X Not sold separately.

Group 5a: Fuel Injection System



Group 5a: Fuel Injection System

Item	Part No.	Description	Qty. Var. 1603	1641	16TR	16TT	164H
1	GM21495	Pump, fuel injection	1				
1	GM21496	Pump, fuel injection		1			
1	GM21497	Pump, fuel injection			1		
1	GM21498	Pump, fuel injection				1	
1	GM32727	Pump, fuel injection					1
2	GM21499	Key, shaft	1	1	1	1	1
3	224172	O-ring	1	1	1	1	
3	GM17487	O-ring					1
4	223471	Washer, lock	1	1			
4	GM21501	Washer			1	1	
4	GM17456	Washer					1
5	224161	Nut	1	1			1
5	GM21500	Nut			1	1	
6	#	Nut	4	4	3	3	3
7	GM21503	Fuel line, no. 1	1	1	1	1	1
8	GM21504	Fuel line, no. 2	1	1	1	1	1
9	GM21505	Fuel line, no. 3	1	1	1	1	1
10	223572	Clamp	1	1			1
11	224071	Clamp	1	1			1
12	#	Screw, cap, M6 x 12	1	1	1	1	1
13	—	Not used					
14	GM21502	Pinion	1	1			
14	224238	Gear			1	1	1
15	223460	Fitting	1	1			
15	223820	Fitting			1	1	1
16	GM21506	Fuel line	1	1			
16	See table below	Fuel line (includes items 17, 18)			1	1	1
16	See table below	Fuel line (includes items 17, 18)			1	1	1
17	360141	Nut			2	2	2
18	223476	Packing			2	2	2
19	223504	Tube (includes items 17, 18)	2	2	2	2	2
20	223710	Plug					1
21	223476	Packing					1
22	GM21455	Line, fuel (includes nut and sealing washer)	1	1	1	1	
22	GM21453	Nut (not shown)	2	2	2	2	
22	GM17494	Washer, sealing (not shown)	2	2	2	2	
22	GM32728	Line, fuel					1
23	222764	Fitting	1	1			
23	360037	Fitting (includes item 24)			1	1	1
24	222760	O-ring	1	1			
24	360178	O-ring			1	1	1
25	GM21508	O-ring			1	1	1
26	GM21509	Switch, temperature			1	1	1
27	GM21510	Harness, wiring			1	1	1
28	GM32784	Solenoid valve coil			1	1	

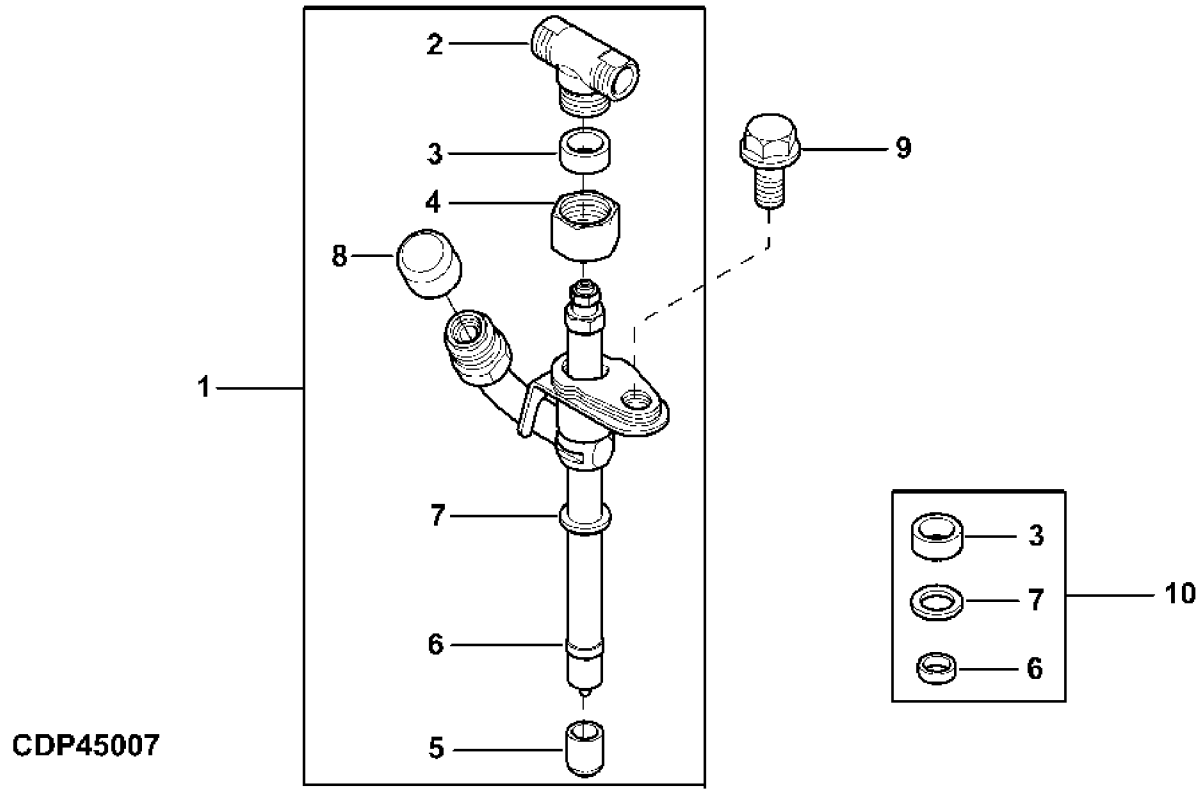
Common hardware; procure locally.

Serial Number-Contingent Fuel Line

Use the engine serial number to verify item16. Find your serial number on the engine nameplate and choose the fuel filter line from the chart below.

Model	Variation	Serial Number	Part Number
3029TF, 60 Hz	16TR	PE3029T266666 and before	GM21507
		After PE3029T266666	GM32738
3029TF, 50 Hz	16TT	PE3029T028590 and before	GM21507
		After PE3029T028590	GM32738

Group 5b: Fuel Injection Nozzle

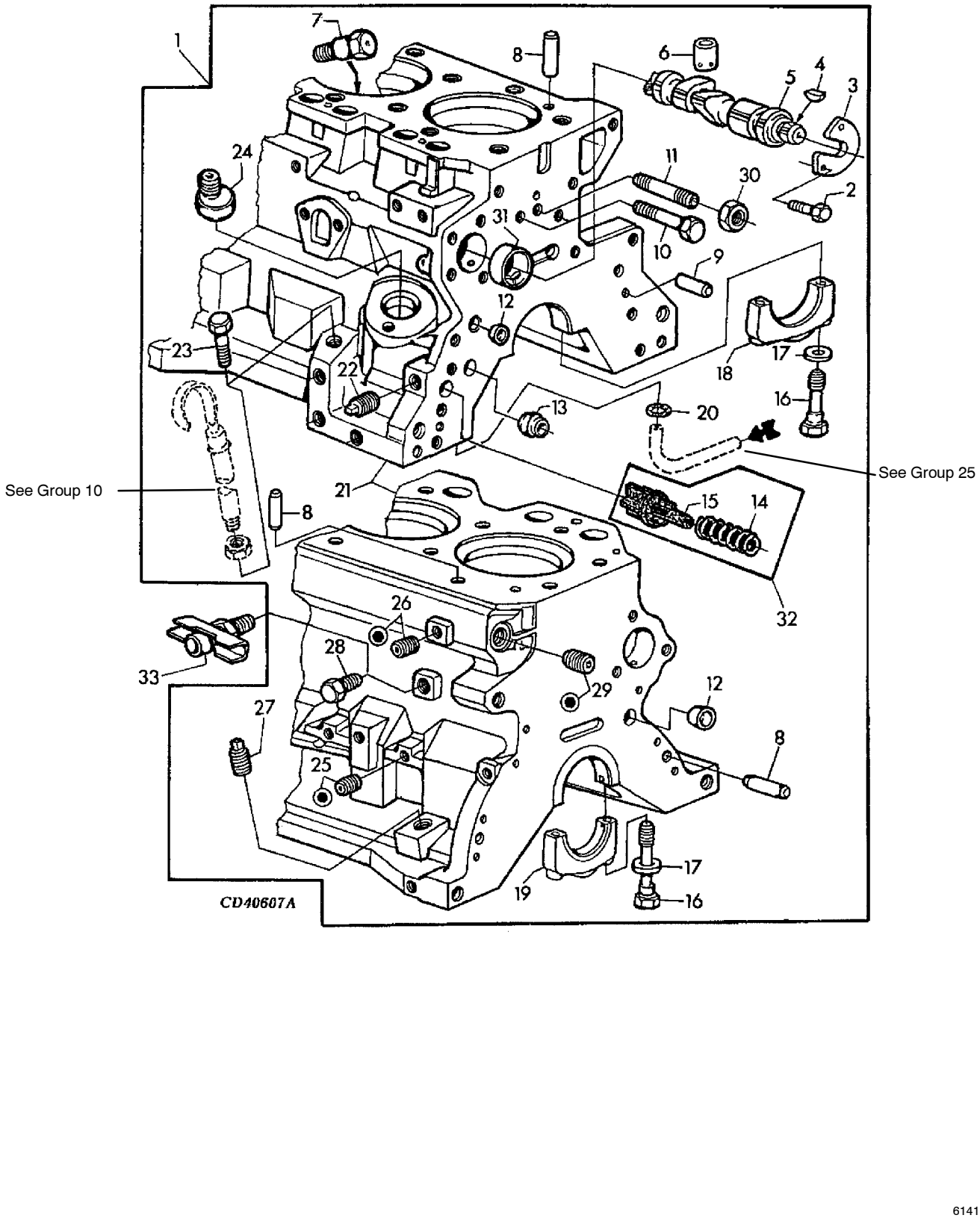


Group 5b: Fuel Injection Nozzle

Item	Part No.	Description	Qty. Var. 1603	1641	16TR	16TT	164H
1	GM21511	Nozzle, injection	3	3			
1	GM21512	Nozzle, injection			3	3	
1	360017	Nozzle, injection					3
2	GM21513	Fitting, tee	1	1	1	1	1
3	X	Washer (order item 10)	1	1	1	1	1
4	223517	Nut, tube	1	1	1	1	1
5	224257	Plug	AR	AR	AR	AR	AR
6	X	Washer (order item 10)	1	1	1	1	1
7	X	Packing (order item 10)	1	1	1	1	1
8	223660	Plug	AR	AR	AR	AR	AR
9	224188	Screw, cap	3	3	3	3	3
10	GM21515	O-ring kit	AR	AR			
10	GM21516	O-ring kit			AR	AR	AR

AR As Required
X Not sold separately.

Group 7: Cylinder Block

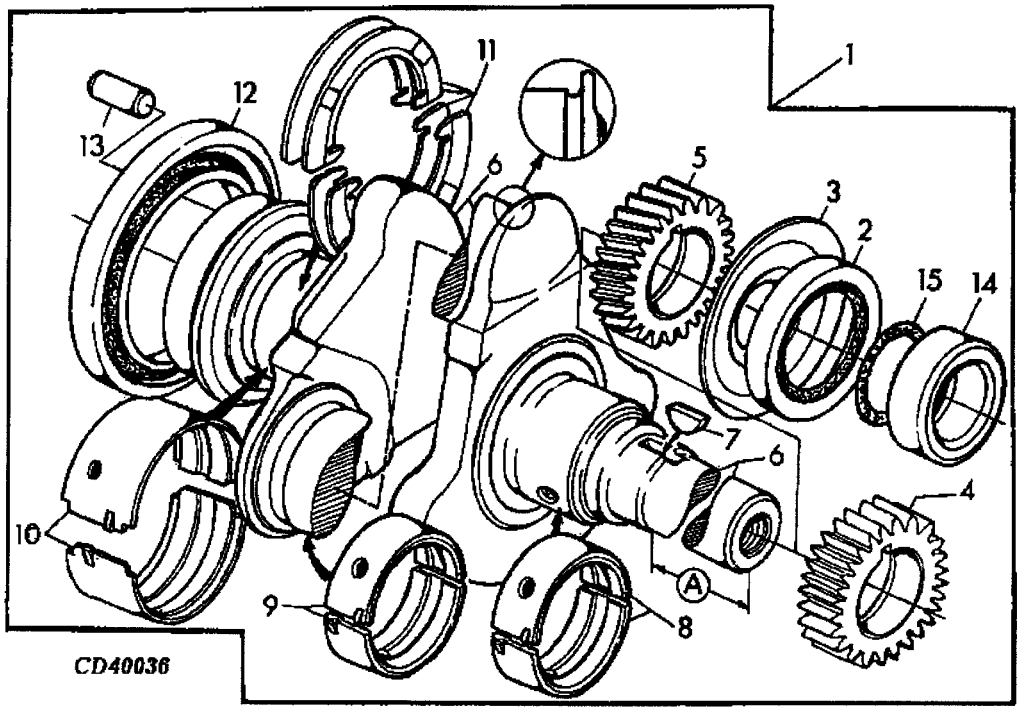


Group 7: Cylinder Block

Item	Part No.	Description	Qty. Var. 4607	Qty. Var. 9906
1	GM21417	Block, cylinder	1	1
2	#	Screw, cap, 3/8 in. x 1 in. (SAE grade 8)	2	2
3	223610	Plate	1	1
4	223407	Key, woodruff	1	1
5	X	Camshaft (order kit part number GM21411)	1	1
6	223611	Tappet	1	6
7	GM21418	Orifice	3	3
8	223472	Pin, dowel	4	4
9	352064	Pin, dowel	2	2
10	#	Screw, cap, 3/8 in. x 2 1/4 in.	2	2
11	#	Stud, 3/8 in. x 47 mm	1	1
12	360517	Cap	AR	AR
13	360518	Bushing	1	1
14	X	Spring (order item 32)	1	1
15	X	Valve (order item 32)	1	1
16	223639	Screw, cap	8	8
17	GM21419	Washer		8
17	224089	Washer	8	
18	223503	Cap, bearing		3
19	223516	Cap		1
20	336458	O-ring	1	1
21	X	Block, cylinder	1	1
22	#	Plug, pipe, 3/8 in.	1	1
23	#	Screw, cap, 1/2 in. x 1/2 in.	1	1
24	223638	Nipple, threaded	1	1
25	224268	Plug, pipe	4	4
26	#	Plug, pipe, 1/4 in.-18 NPT	1	1
27	#	Plug, pipe, 1/2 in.-14 NPT	1	1
28	223802	Plug, pipe		1
28	#	Plug, pipe, 1/4 in.	1	
29	#	Plug, pipe, 1 in.-11.5 NPT	1	1
30	#	Nut, 3/8 in.-16UNC	1	1
31	352246	Bushing	1	1
32	GM21420	Valve kit	AR	AR
33	223435	Valve, drain	AR	AR

Common hardware; procure locally.
AR As Required
X Not sold separately.

Group 8a: Crankshaft



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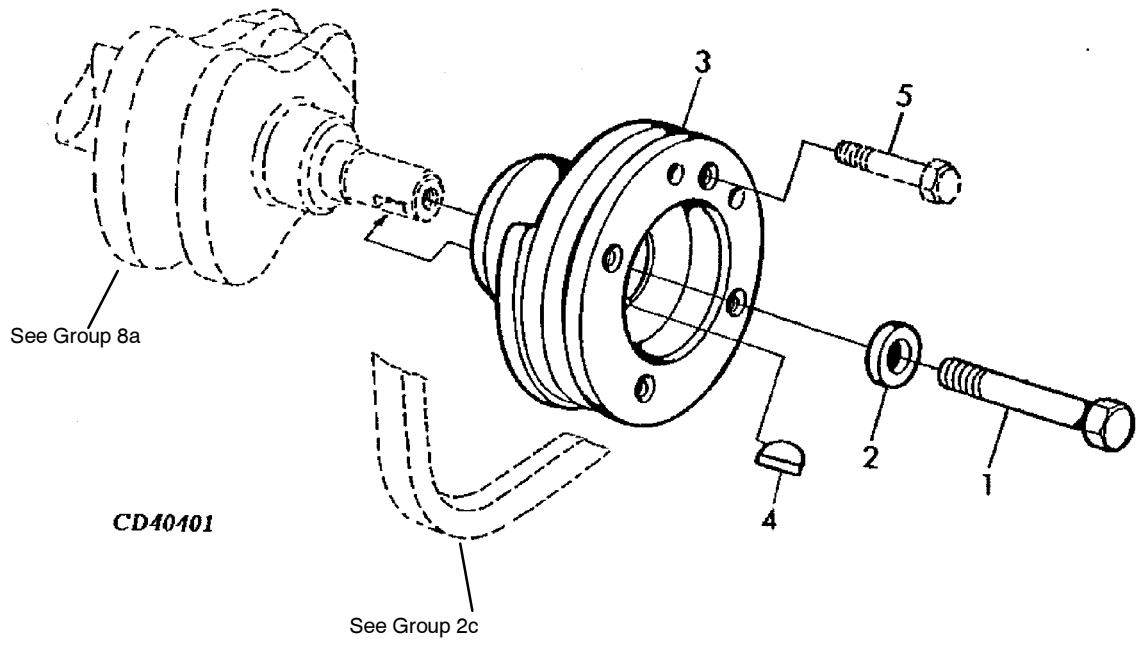
Item	Part No.	Description	Qty. Var. 4702	Qty. Var. 9919
1	GM21421	Crankshaft	1	1
2	223422	Seal	1	1
3	223607	Slinger, oil	1	1
4	Not used		1	1
5	223615	Gear	1	1
6	X	Crankshaft	1	1
7	223407	Key, woodruff	1	1
8	GM21422	Bearing kit, standard	3	3
8	GM21423	Bearing kit, 0.25 mm US	AR	AR
9	GM21424	Bearing kit, standard	3	3
10	GM21425	Bearing kit, thrust standard	1	1
10	GM21426	Bearing kit, thrust 0.25 mm US	AR	AR
11	GM21427	Washer, thrust standard	1	1
11	GM21428	Washer, thrust 0.1 mm OS	AR	AR
12	223583	Seal, rear	1	1
13	223472	Pin, dowel	1	1
14	224056	Sleeve	AR	AR
15	224007	Ring	AR	AR

X Not sold separately.
AR As Required

Group 8b: Crankshaft Pulley



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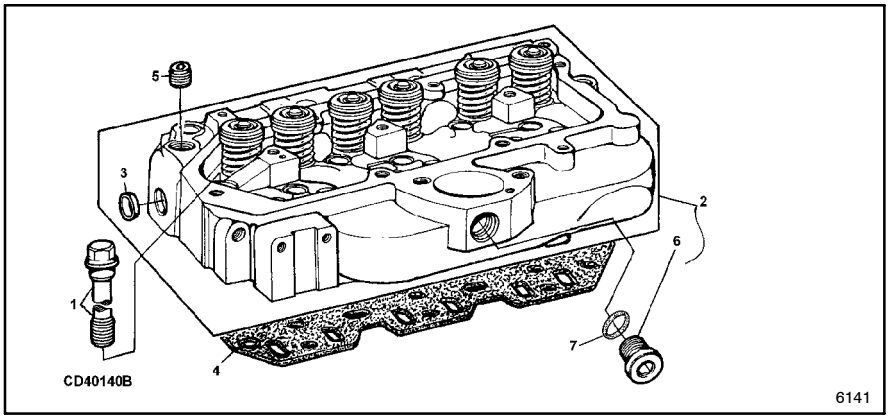
Item	Part No.	Description	Qty. Var. 1330
1	#	Screw, cap, 1/2 in. x 1 3/4 in. (SAE grade 8)	14
2	352035	Spacer	1
3	GM21429	Sheave (pulley)	1
4	GM21430	Key, shaft, 5/16 in. x 1 1/8 in.	1
5	#	Screw, cap, 3/8 in.-16UNC	AR

Common hardware; procure locally.
AR As Required

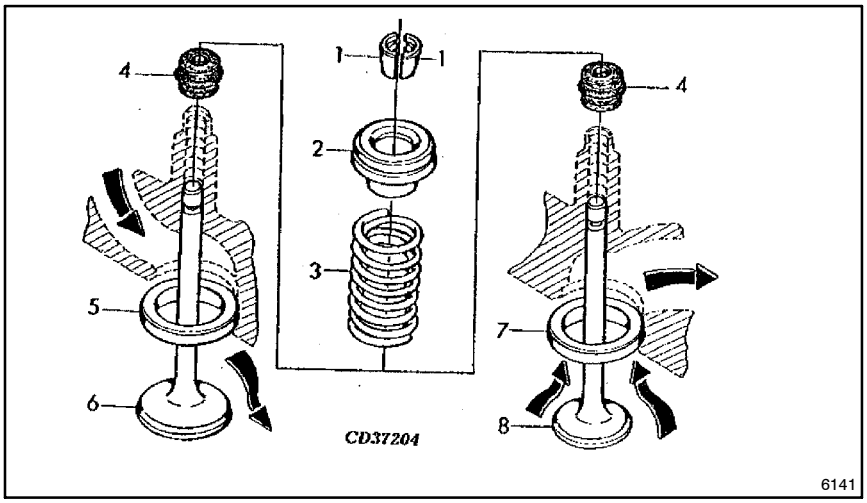
Group 9a: Cylinder Head and Valves



Item	Part No.	Description	Qty. Var. 5105	Qty. Var. 9902
1	224164	Screw, cap	14	14
2	GM21431	Head, cylinder	1	1
3	223448	Cap	2	2
4	GM32729	Gasket, cylinder head	1	
4	GM21432	Gasket, cylinder head		1
5	#	Plug, pipe, 1/2 in.-14 NPTF	AR	AR
6	360174	Fitting (also order item 7)	1	
7	223746	O-ring	1	

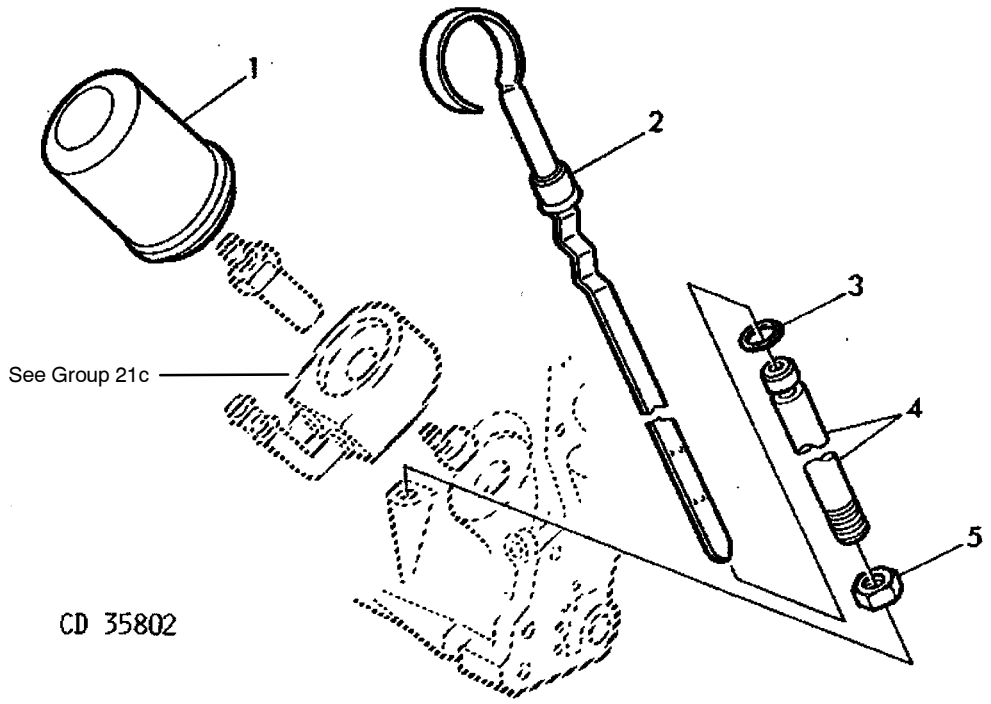
Common hardware; procure locally.
AR As Required

Group 9b: Valves



Item	Part No.	Description	Qty. Var. 5105	Qty. Var. 9903
1	224184	Lock	12	12
2	224176	Rotator	6	6
3	223455	Spring	6	6
4	224243	Seal	6	6
5	GM21433	Insert, valve	6	6
6	224168	Valve, intake, standard	3	3
6	224193	Valve, intake, OS, 0.381 mm	AR	AR
6	224197	Valve, intake, OS, 0.762 mm	AR	AR
7	GM21434	Insert, valve	6	6
8	224156	Valve, exhaust	3	3
8	224153	Valve, exhaust, OS, 0.381 mm	AR	AR
8	224151	Valve, exhaust, OS, 0.762 mm	AR	AR

Group 10: Oil Filter & Dipstick



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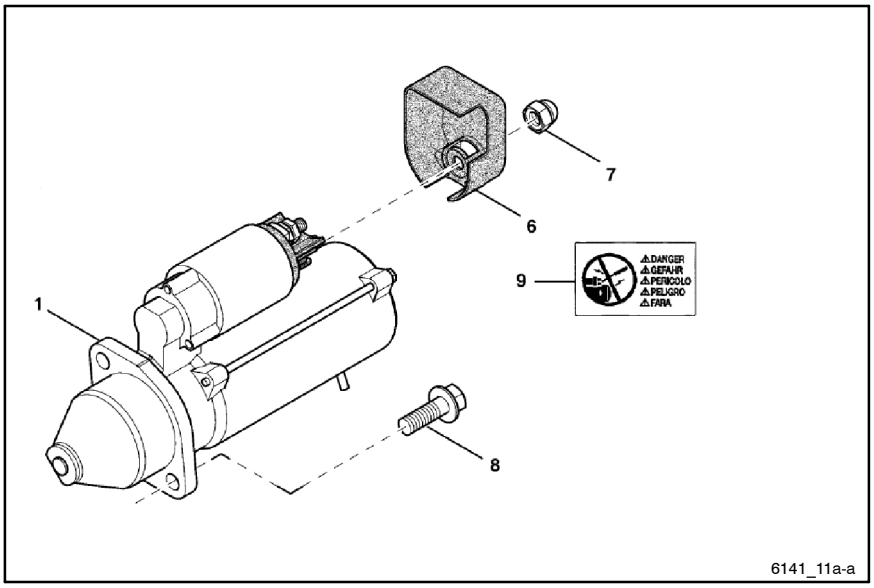
Item	Part No.	Description	Qty. Var. 4004	4006	5939
1	223604	Filter, oil	1	1	
1	GM34935	Filter, oil			1
2	223443	Dipstick	1	1	1
3	223454	O-ring	1	1	1
4	223502	Nipple, threaded	1		
4	GM21435	Guide, dipstick		1	1
5	#	Nut, 1/2 in.	1	1	1

Common hardware; procure locally.

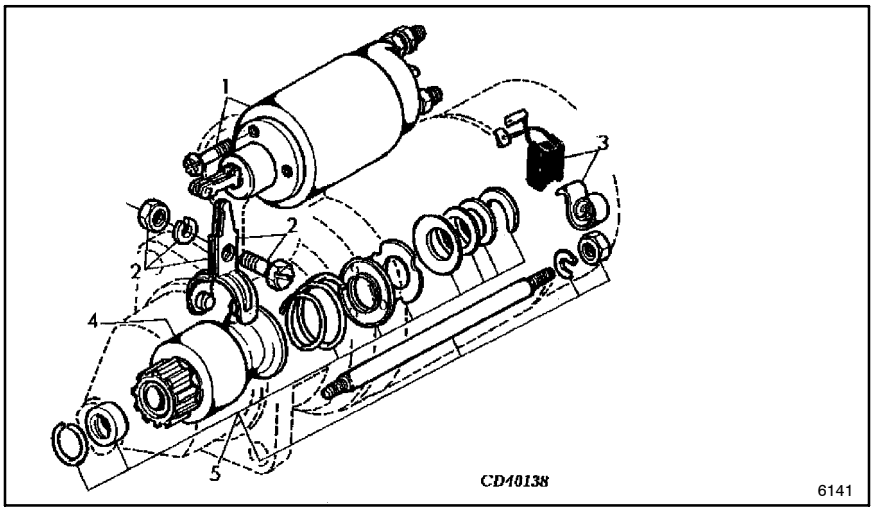
Group 11a: Starter Motor



Item	Part No.	Description	Qty. Var. 3008
1	GM21436	Starter	1
6	GM40186	Cover	1
7	#	Nut, M10	1
8	#	Screw, 3/8 in. x 1 1/8 in.	2
9	X	Label	1

\# Common hardware; procure locally.
X Not sold separately.

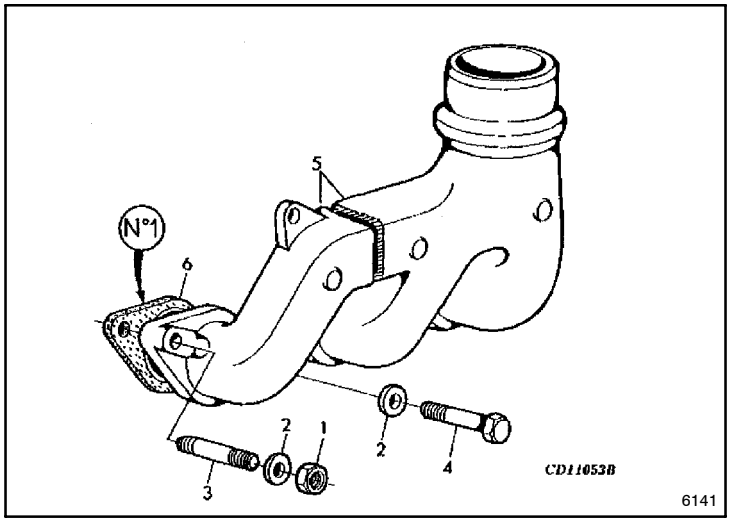
Group 11b: Starter Motor Components



Item	Part No.	Description	Qty. Var. 3008
1	GM40185	Solenoid	1
2	*	Shifter	1
3	*	Brush kit	1
4	GM40184	Starter motor drive	1
5	*	Seal kit	1

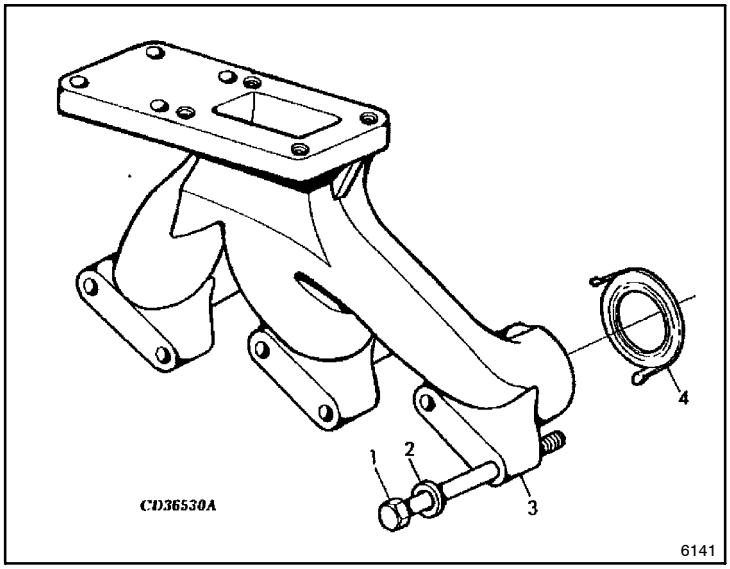
* Contact factory for part number.

Group 12a: Exhaust Manifold



Item	Part No.	Description	Qty. Var. 2802D
1	336726	Nut, hex	2
2	#	Washer, 10 x 18 x 2.500 mm	6
3	#	Stud, 9.525 x 48.500 mm	2
4	#	Screw, 3/8 in. x 1 1/4 in. (SAE grade 8)	4
5	GM21443	Manifold, exhaust	1
6	GM21444	Gasket	3

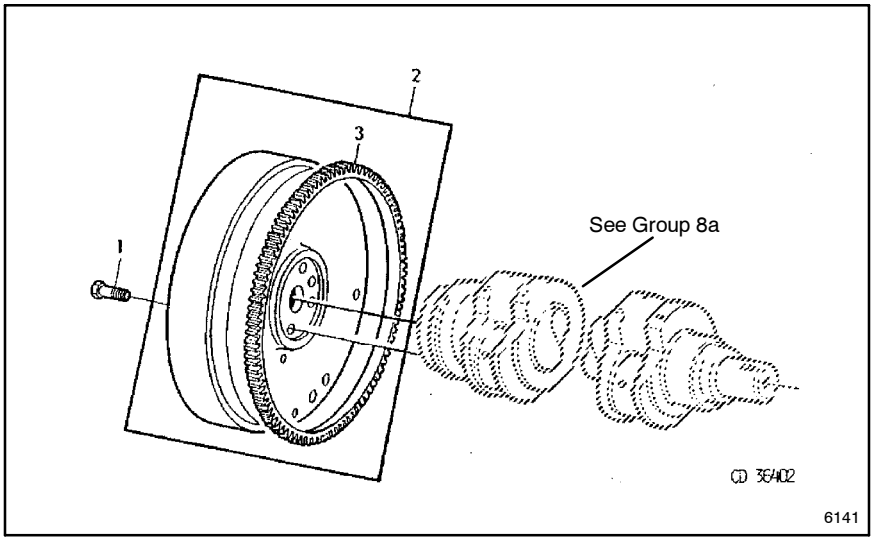
Common hardware; procure locally.



Item	Part No.	Description	Qty. Var. 2802T
1	336724	Screw, hex head	6
2	#	Washer, 10 x 18 x 2.500 mm	6
3	GM21445	Manifold, exhaust	1
4	GM21446	Gasket	3

Common hardware; procure locally.

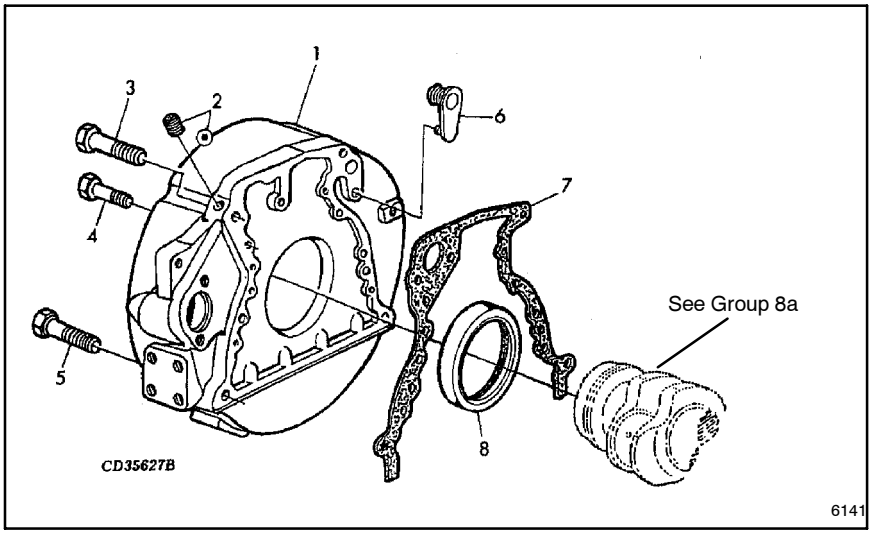
Group 13a: Flywheel



Item	Part No.	Description	Qty. Var. 1501
1	#	Screw, cap, 1/2 in. x 1 1/2 in.	4
2	GM21447	Flywheel	1
3	223613	Gear, flywheel ring	1

Common hardware; procure locally.

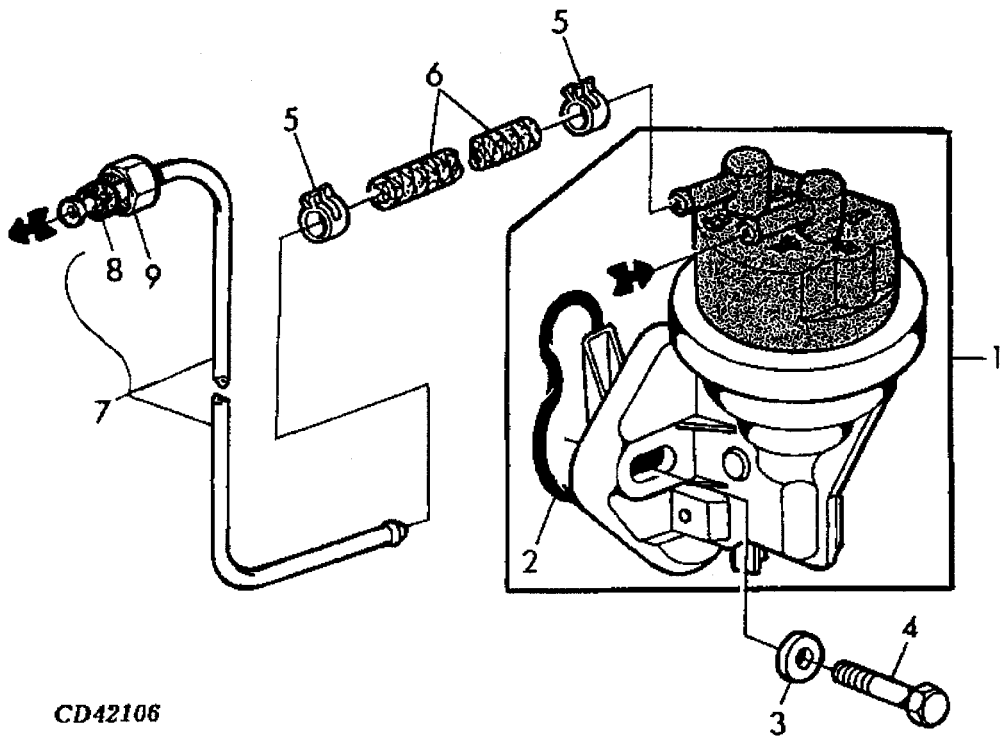
Group 13b: Flywheel Housing



Item	Part No.	Description	Qty. Var. 1418	Qty. Var. 1453
1	GM21448	Housing	1	
1	GM32730	Housing		1
2	224268	Plug, pipe	AR	
3	#	Screw, cap, 5/8 in. x 3 in. (SAE grade 8)	2	
3	#	Screw, cap, 5/8 in. x 2 1/2 in.		2
4	#	Screw, cap, 3/8 in. x 1 3/8 in. (SAE grade 8)	8	8
5	#	Screw, cap, 5/8 in. x 5 1/2 in. (SAE grade 8)	2	2
6	360582	Plug	1	1
7	223558	Gasket	1	1
8	223583	Seal	1	1

Common hardware; procure locally.
AR As Required

Group 14: Fuel Pump



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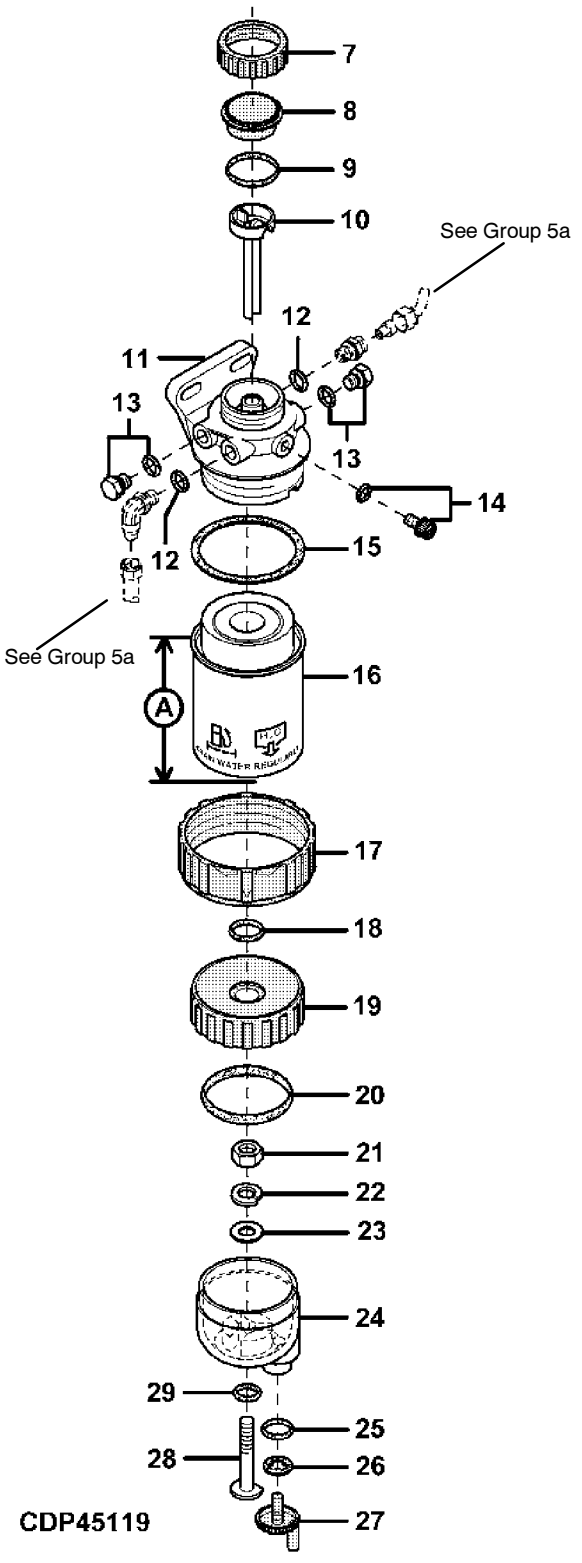
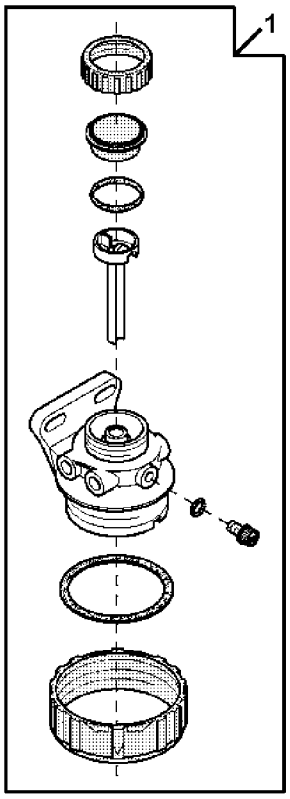
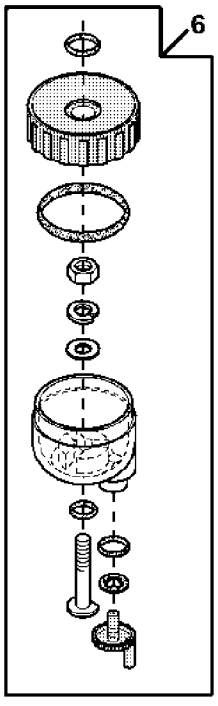
Item	Part No.	Description	Qty. Var. 3710
1	GM21449	Pump, fuel	1
2	GM17555	O-ring, 44.12 x 2.616	1
3	#	Washer, 11/32 in. x 11/16 in. x 0.065 in.	2
4	#	Screw, cap, 5/16 in. x 7/8 in.	2
5	GM21450	Clip	2
6	GM21451	Hose	1
7	GM21452	Line, fuel	1
8	GM17494	Washer, sealing	1
9	GM21453	Nut	1

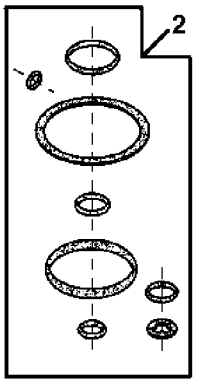
Common hardware; procure locally.

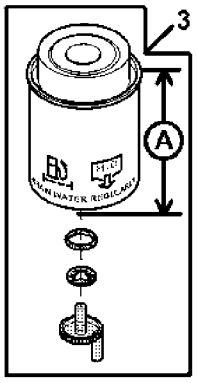
Group 15: Fuel Filter

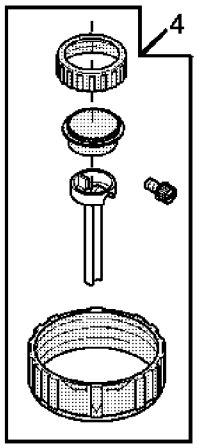


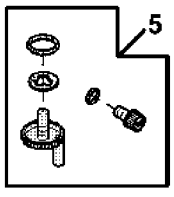












6141

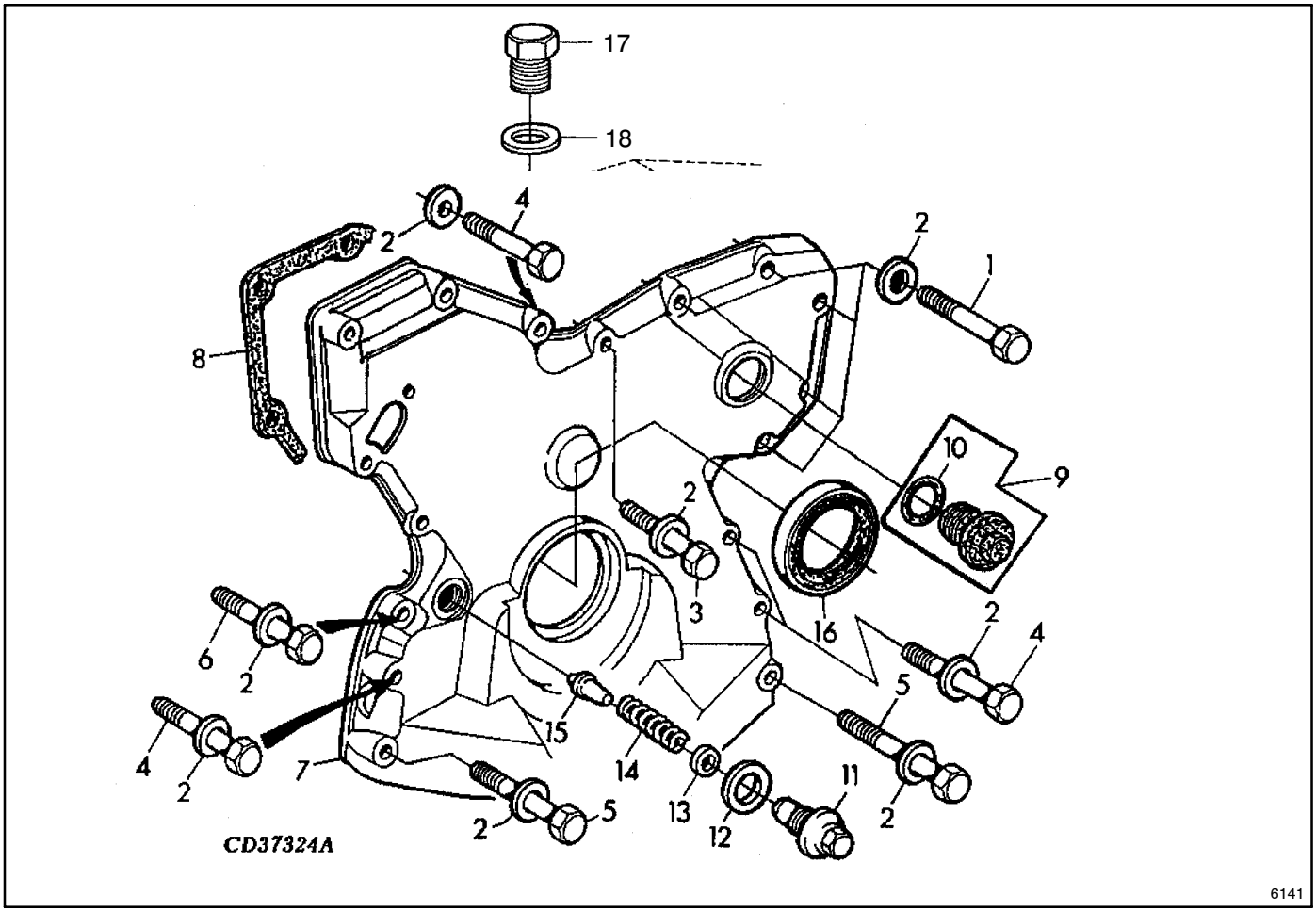
Group 15: Fuel Filter

Item	Part No.	Description	Qty. Var. 1	Qty. Var. 35DD
1	GM17543	Kit	1	1
2	222772	Kit	1	1
3	275501	Filter, fuel	1	
3	~~336545~~	Filter, fuel (also order item 15)		1
4	222773	Seal kit	1	1
5	360048	Kit	1	1
6	GM32731	Kit, sediment bowl		1
7	—	Retainer	1	1
8	—	Retainer (order item 1 or 4)	1	1
9	—	Seal (order item 2)	1	1
10	—	Retainer (order item 1 or 4)	1	1
11	—	Filter head (order item 1)	1	1
12	360178	O-ring	2	2
13	#	Plug, pipe, M12 x 1.5	2	
13	360015	Plug		2
14	—	Drain plug (order item 1 or 4or 5)	1	1
15	GM17445	Seal	1	1
16	—	Filter element (order item 3)	1	1
17	—	Retainer (order item 1 or 4)		1
18	—	O-ring (order item 2 or 6)		1
19	—	Wing nut (order item 6)		1
20	—	O-ring (order item 2 or 6)		1
21	—	Nut (order item 6)		1
22	—	Lock Washer (order item 6)		1
23	—	Washer (order item 6)		1
24	—	Bowl, sediment (order item 6)		1
25	—	O-ring (order item 6 or 2 or 5)		1
26	—	Gasket (order item 6 or 2 or 5)		1
27	—	Drain plug (order item 6 or 5)		1
28	—	Screw (order item 6)		1
29	—	O-ring (order item 6 or 2 or 5)		1

336661

Common hardware; procure locally.

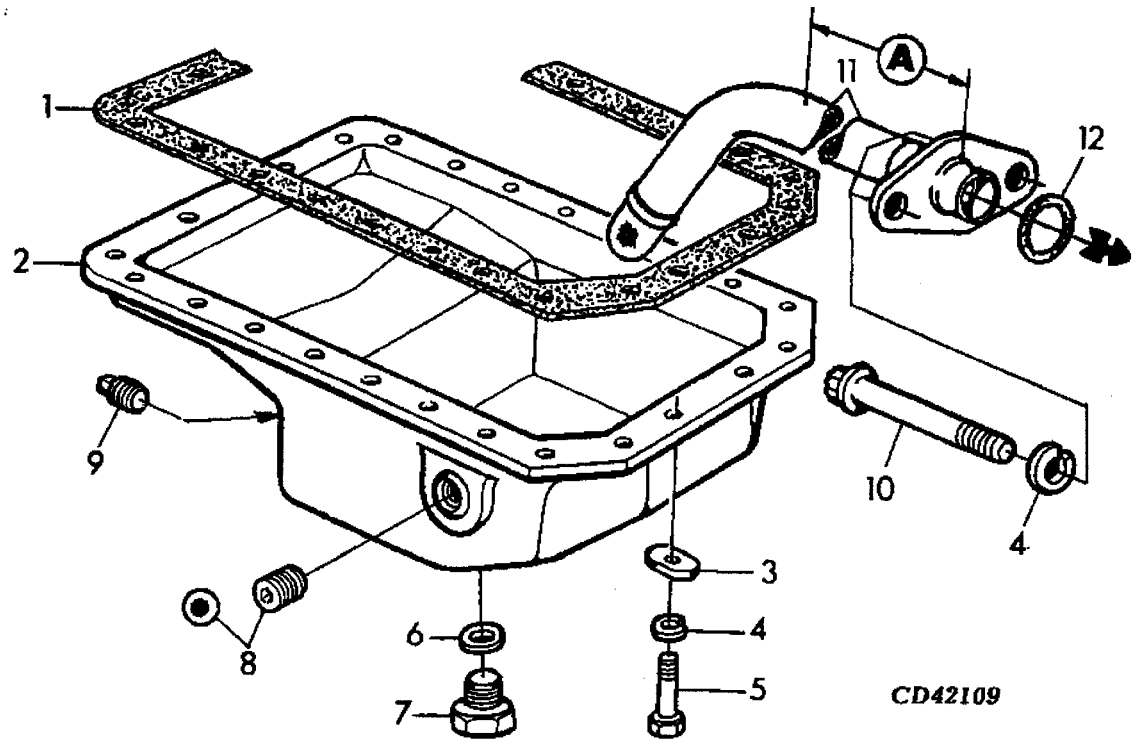
Group 18: Timing Gear Cover



Item	Part No.	Description	Qty. Var. 4499
1	#	Screw, cap, 3/8 in. x 2 in. (SAE grade 8)	5
2	#	Washer, 10 x 18 x 2.500 mm	13
3	#	Screw, cap, 3/8 in. x 2 1/4 in.	1
4	#	Screw, cap, 3/8 in. x 2 3/8 in. (SAE grade 8)	4
5	#	Screw, cap, 3/8 in. x 2 1/2 in. (SAE grade 8)	2
6	#	Screw, cap, 3/8 in. x 1 7/8 in.	1
7	336451	Cover kit	1
8	223620	Gasket	1
9	GM32732	Fitting	1
10	GM21456	O-ring	1
11	336454	Plug, fitting	1
12	223410	Washer	1
13	#	Washer, 21/64 in. x 3/4 in. x 0.035 in.	AR
14	224095	Spring	1
15	224058	Valve	1
16	223422	Seal	1
17	223451	Plug, drain	1
18	GM21460	Washer	1

Common hardware; procure locally.
AR As Required

Group 21a: Oil Pan

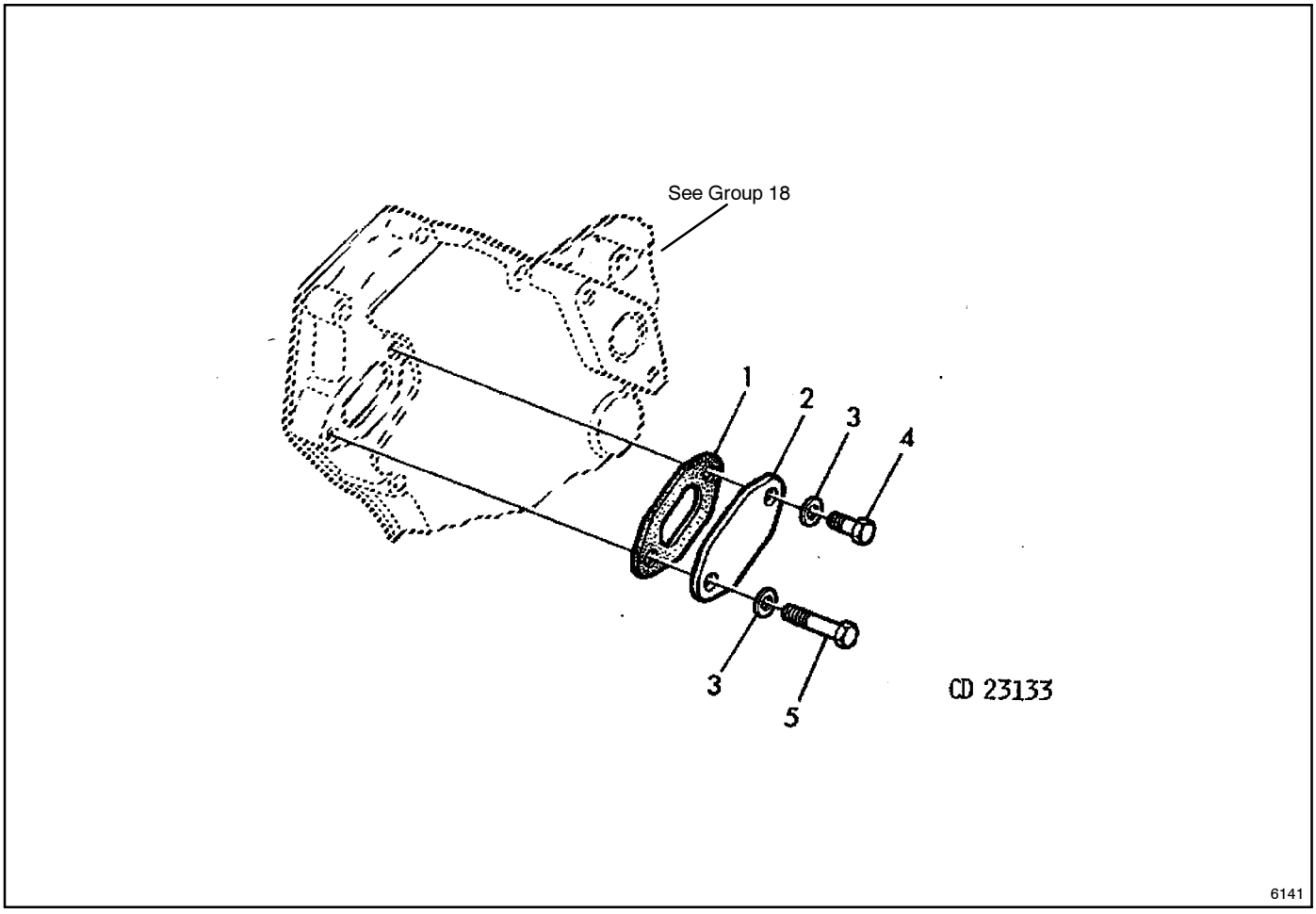


6141

Item	Part No.	Description	Qty. Var. 1901
1	GM21457	Gasket	1
2	GM21458	Pan, oil	1
3	GM21459	Strap	24
4	#	Washer, lock, 3/8 in.	26
5	#	Screw, cap, 3/8 in. x 1 in. (SAE grade 8)	24
6	GM21460	Ring, copper	1
7	223616	Plug, drain	1
8	#	Plug, 1/2 in.-14 NPT	1
9	#	Plug, 3/4 in.-14 NPT	1
10	#	Screw, cap, 120 mm	2
11	GM21461	Intake, oil pump	1
12	224035	O-ring	1

Common hardware; procure locally.

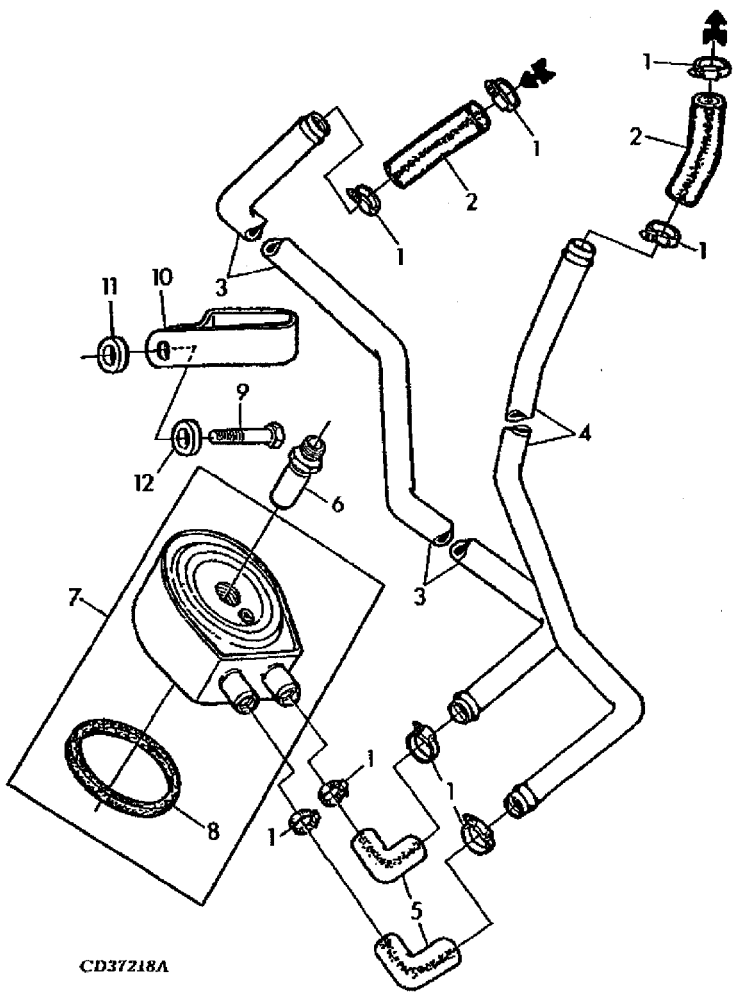
Group 21b: Oil Fill Tube



Item	Part No.	Description	Qty. Var. 1299
1	223559	Gasket	1
2	GM21462	Cover	1
3	#	Washer, 10 x 18 x 2.500 mm	2
4	#	Screw, cap, 3/8 in. x 7/8 in.	1
5	#	Screw, cap, 3/8 in. x 2 1/4 in.	1

Common hardware; procure locally.

Group 21c: Oil Cooler

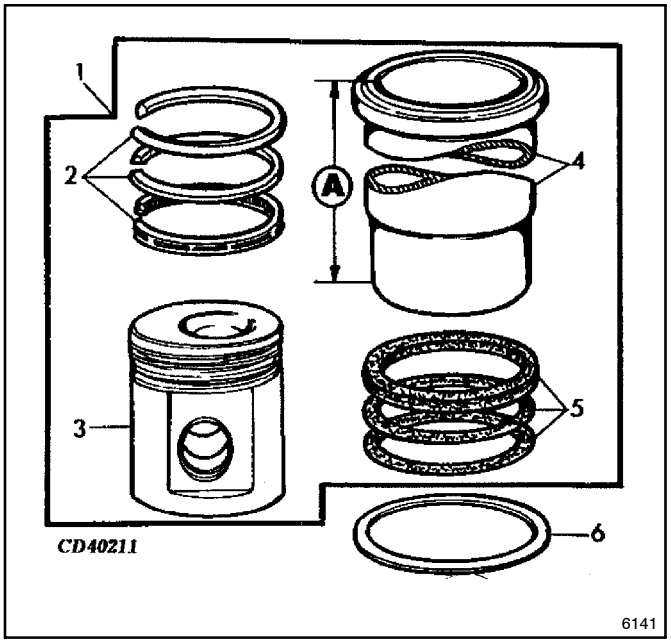


6141

Item	Part No.	Description	Qty. Var. 5906	Qty. Var. 5939
1	GM21409	Clamp	8	8
2	GM21463	Hose	2	2
3	336462	Line	1	1
4	336461	Line	1	1
5	336463	Hose	2	2
6	GM21464	Nipple, threaded	1	
6	GM32733	Adapter		1
7	GM21465	Cooler, oil	1	1
8	GM21466	Packing	1	1
9	#	Screw, cap, 3/8 in. x 2 3/8 in. (SAE grade 8)	1	1
10	336466	Clamp	1	1
11	336467	Washer	1	1
12	#	Washer, 10 x 18 x 2.5 mm	1	1

Common hardware; procure locally.

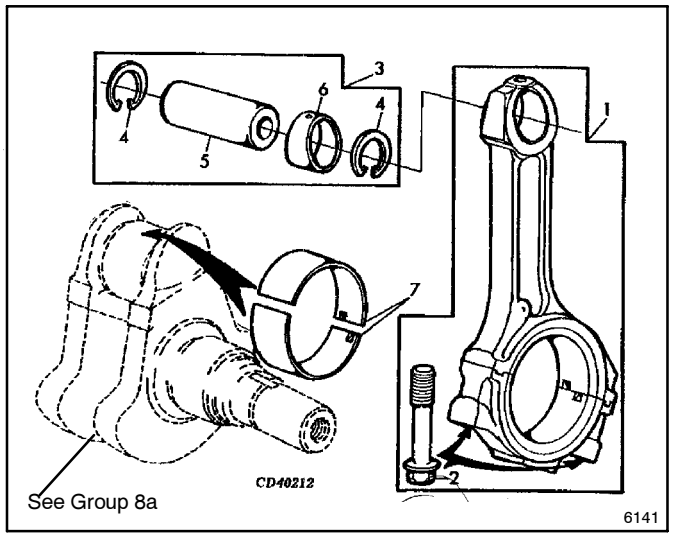
Group 22a: Piston



Item	Part No.	Description	Qty. Var. 9915	9917	4814
1	GM21472	Piston-liner kit	3		
1	GM21476	Piston-liner kit		3	3
2	360066	Ring kit	1	1	1
3	X	Piston	1	1	1
4	GM21473	Liner, cylinder	1	1	
4	X	Liner, cylinder			1
5	223419	O-ring kit	1	1	1
6	GM21474	Shim, 0.05 mm	AR	AR	AR
6	GM21475	Shim, 0.1 mm	AR	AR	AR

AR As Required
X Not sold separately.

Group 22b: Connecting Rod

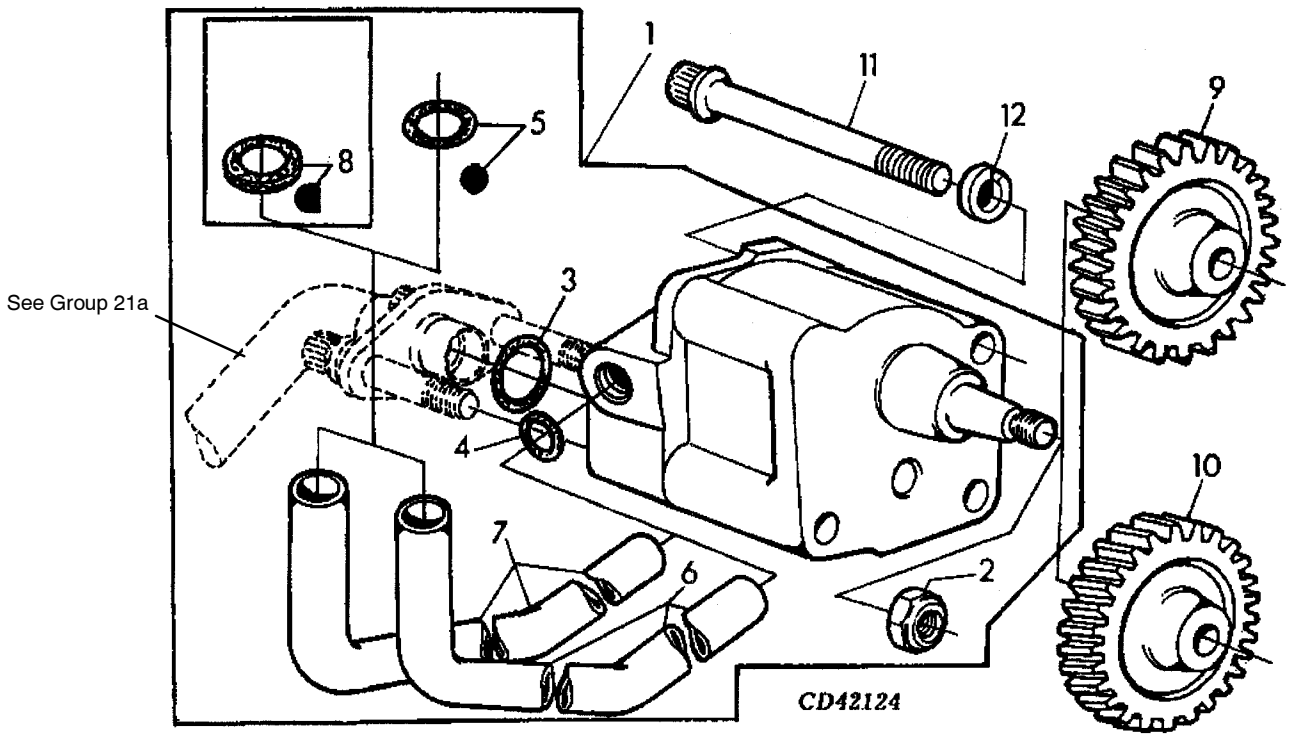


See Group 8a

Item	Part No.	Description	Qty. Var. 9916	9918	4814
1	GM21470	Connecting rod kit (includes items 2-4, 5)	3		
1	GM21467	Rod, connecting (includes item 2)		3	
1	GM32734	Rod, connecting (includes items 2, 3)			3
2	223528	Screw	2	2	
2	GM17477	Screw			2
3	GM21468	Piston pin kit (includes items 4-6)		3	3
4	GM21471	Ring, snap	2		
4	223479	Ring, snap		2	2
5	X	Pin, piston (order item 1)	1		
5	X	Pin, piston (order item 3)		1	1
6	X	Bushing		1	1
7	GM21424	Bearing kit, standard	3	3	3
7	GM21469	Bearing kit, 0.25 mm US	AR	AR	

AR As Required
X Not sold separately.

Group 25: Oil Pump

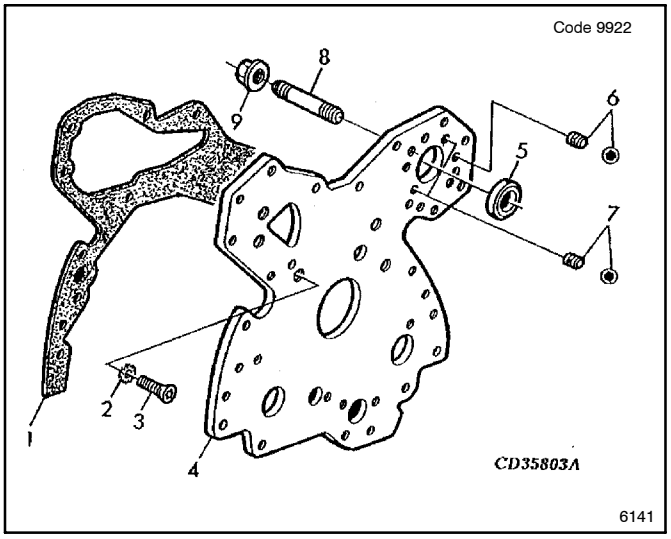


6141

Item	Part No.	Description	Qty. Var. 5001	Qty. Var. 9928
1	GM21477	Oil pump kit	1	1
2	#	Nut, 1/2 in.-13UNC	1	1
3	224035	O-ring	1	1
4	223511	O-ring	1	1
5	336458	O-ring	AR	AR
7	GM21478	Tube, oil	1	1
8	223512	O-ring	AR	AR
9	Not used		1	1
10	223631	Gear	1	1
11	224274	Screw, cap	1	1
12	#	Washer, lock, 3/8 in.	1	1

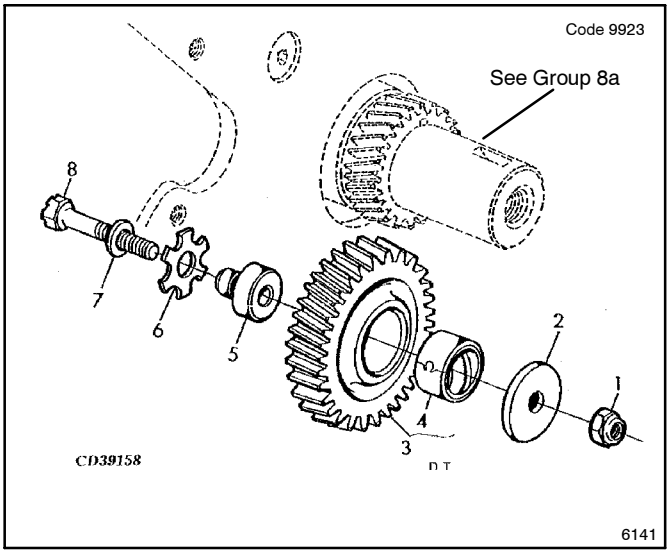
Common hardware; procure locally.
AR As Required

Group 26: Front Plate



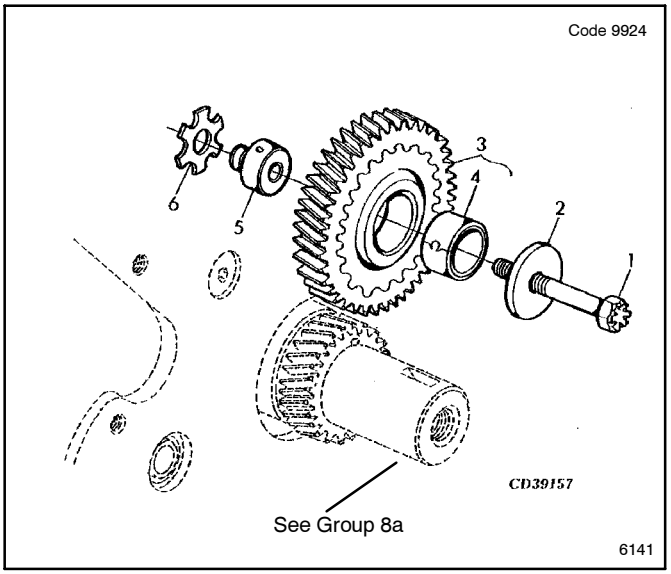
Item	Part No.	Description	Qty. Var. 1	Qty. Var. 3622
1	GM21479	Gasket	1	1
2	#	Washer, 3/8 in.	5	5
3	224333	Screw	5	
3	GM32735	Bolt		5
4	GM21480	Plate (also order items 6 and 7)	1	1
5	GM21481	Washer	AR	AR
6	223442	Screw, set	8	8
7	223445	Screw, set	2	2
8	224335	Stud	3	3
9	#	Nut, 5/16 in.-18UNC	3	3

Common hardware; procure locally.
AR As Required



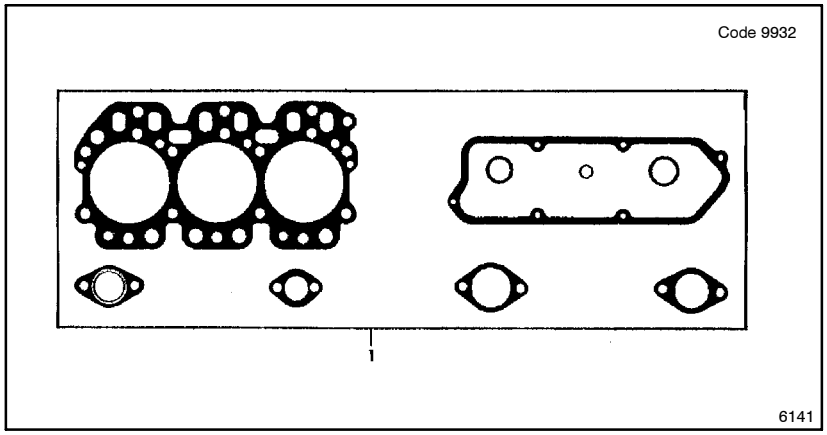
Item	Part No.	Description	Qty. Var. 1	Qty. Var. 3622
1	#	Nut, 1/2 in.-20UNF	1	1
2	336447	Washer, thrust	1	1
3	223729	Gear	1	1
4	223984	Bushing	1	1
5	224186	Pin	1	1
6	336446	Washer, thrust	1	1
7	224267	Washer	1	1
8	224260	Screw, hex head	1	1

Common hardware; procure locally.



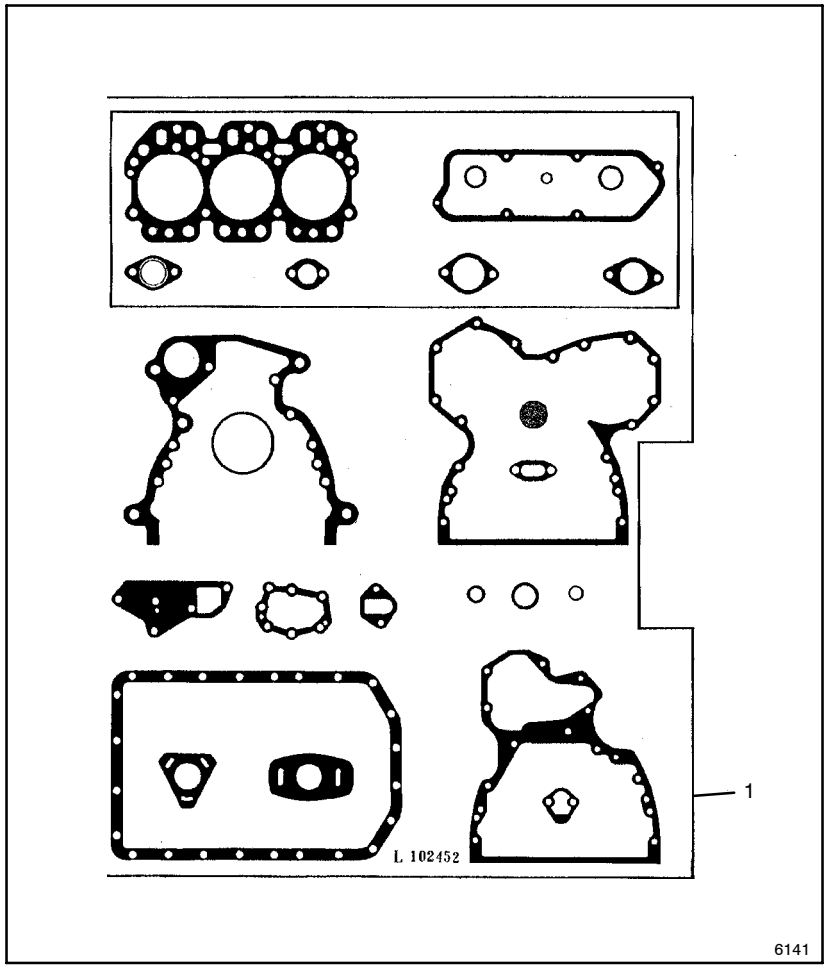
Item	Part No.	Description	Qty. Var. 1
1	223652	Screw	1
2	336447	Washer, thrust	1
3	223432	Gear	1
4	223606	Bushing	1
5	224186	Pin	1
6	336446	Washer, thrust	1

Group 39a: Cylinder Head Gasket Set



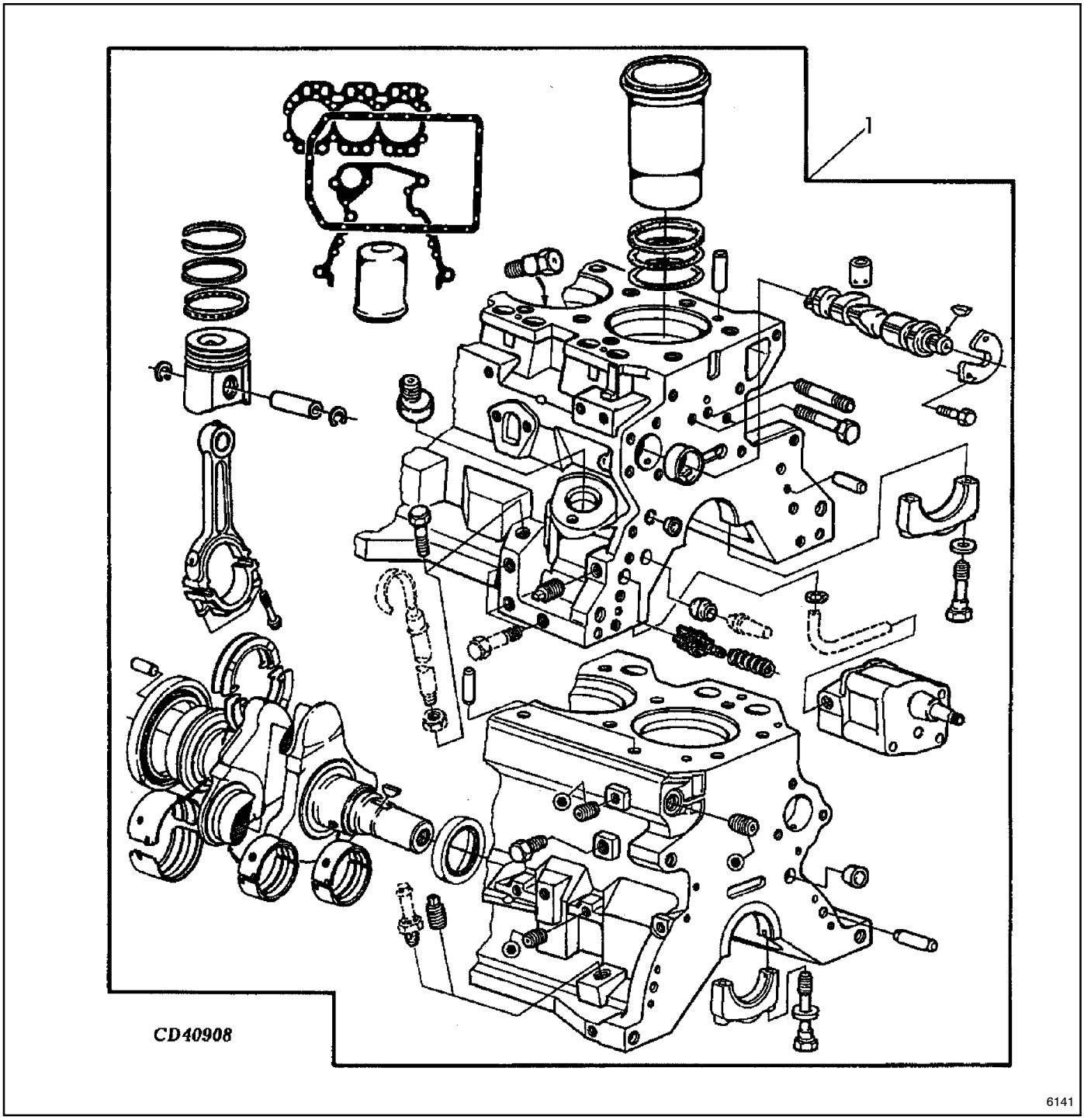
Item	Part No.	Description	Qty. Var. 1	Qty. Var. 9706
1	GM21482	Gasket kit	1	1

Group 39b: Overhaul Gasket Set



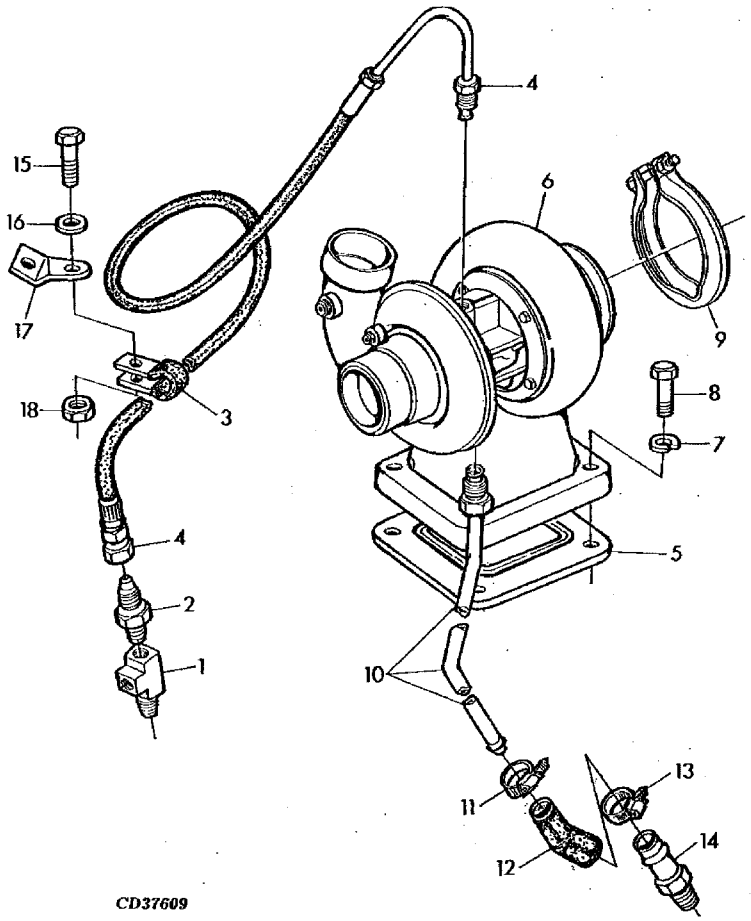
Item	Part No.	Description	Qty. Var. 9932	Qty. Var. 9706
1	GM21483	Gasket kit	1	1

Group 42: Short Block



Item	Part No.	Description	Qty. Var. 9702	Qty. Var. 9910
1	GM32736	Short block assembly	1	
1	GM21484	Short block assembly		1

Group 50: Turbocharger & Oil Lines



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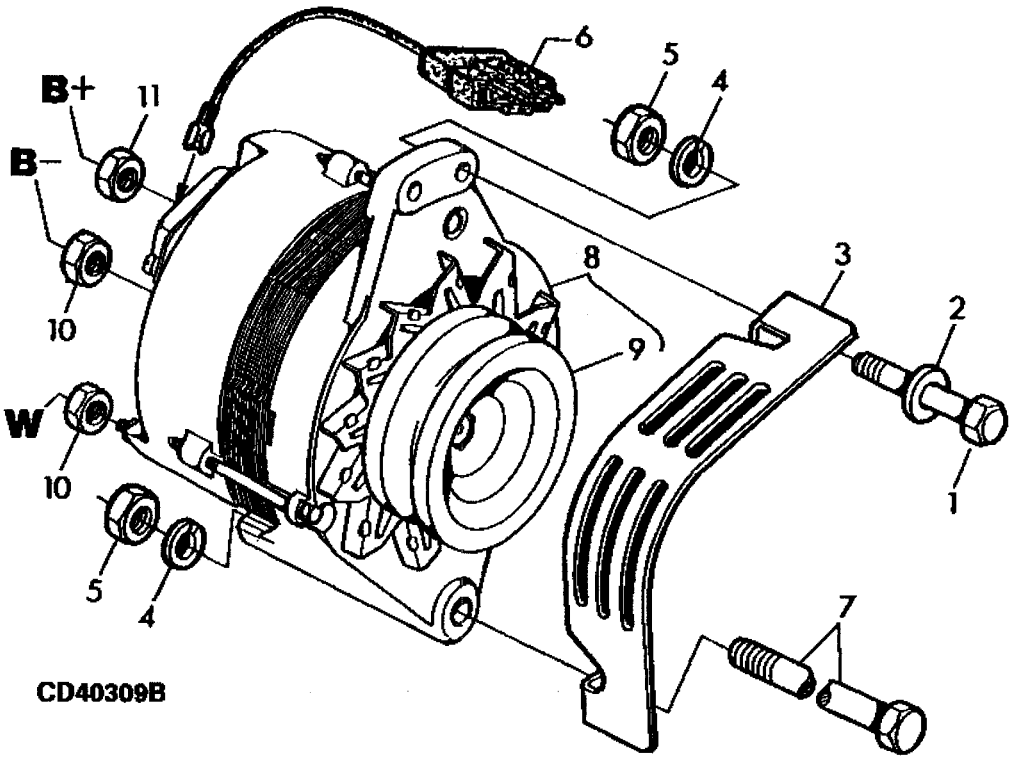
Item	Part No.	Description	Qty. Var. 6547	Qty. Var. 65BS
1	336477	Fitting, tee	1	1
2	223457	Fitting	1	1
3	336721	Clamp	1	1
4	GM21485	Hose, hydraulic	1	1
5	GM21486	Gasket	1	1
6	GM21487	Turbocharger	1	
6	GM21488	Turbocharger		1
7	#	Washer, lock, 8.100 mm	4	4
8	#	Screw, cap, 5/16 in. x 7/8 in.	4	4
9	GM21489	Clamp	1	1
10	GM21490	Line, oil	1	1
11	GM21409	Clamp	1	1
12	GM21491	Hose	1	1
13	336475	Clamp	1	1
14	GM21492	Fitting, hose	1	1
15	#	Screw, cap, 3/8 in x 7/8 in.	1	
16	#	Washer, 10.5 x 18 x 1.6 mm	1	
17	GM32737	Bracket	1	
18	#	Nut, 5/16 in.	1	
19	#	Screw, cap, 5/16 in. x 3/4 in.	1	

Common hardware; procure locally.

Group 51a: Alternator

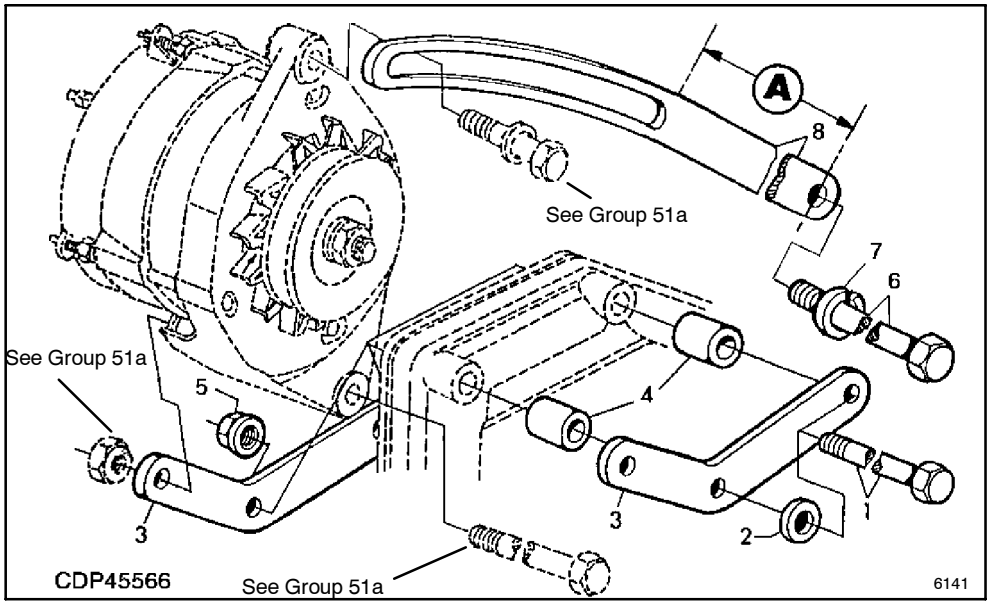


6141

Item	Part No.	Description	Qty. Var. 3123
1	#	Screw, cap, 5/16 in. x 1 3/8 in.	1
2	#	Washer, 11/32 in. x 3/4 in. x 0.120 in.	1
3	GM21517	Shield	1
4	#	Washer, lock, 8.100 mm	2
5	#	Nut, 5/16 in.	1
6	GM21518	Harness, wiring	1
7	#	Screw, cap, 5/16 in. x 3 3/4 in.	1
8	GM21519	Alternator	1
9	GM21520	Sheave	1
10	#	Nut, lock, M5	2
11	#	Nut, lock, M6	1

Common hardware; procure locally.

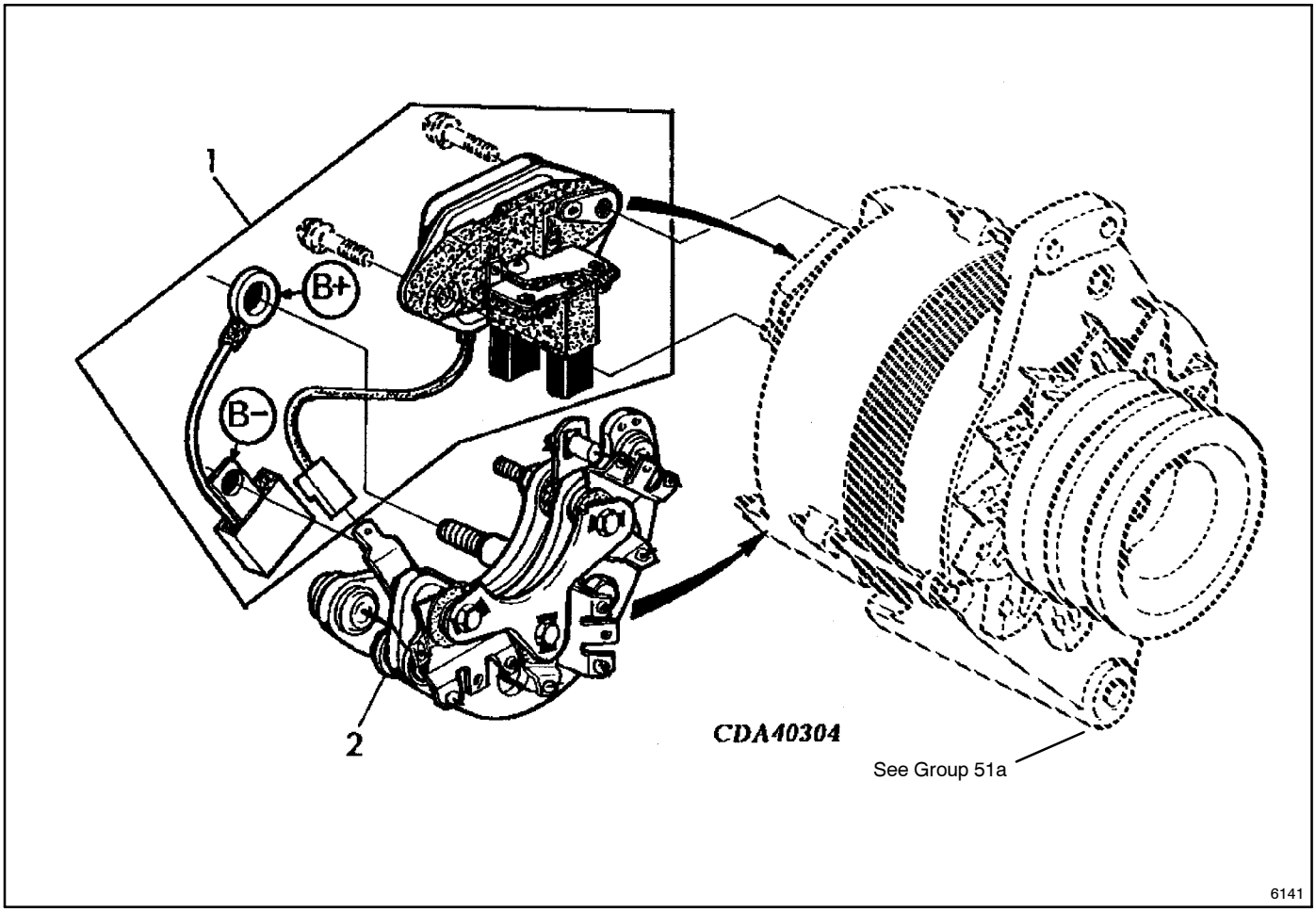
Group 51b: Alternator Brackets



Item	Part No.	Description	Qty. Var. 6218
1	#	Screw, cap, 3/8 in. x 3 1/2 in.	2
2	#	Washer, 10.5 x 18 x 1.6 mm	2
3	GM21493	Bracket	2
4	GM21494	Spacer	2
5	#	Nut, lock, 3/8 in.	2
6	#	Screw, cap, 3/8 in. x 2 in. (SAE grade 8)	1
7	#	Washer, lock, 3/8 in.	1
8	224099	Strap	1

Common hardware; procure locally.

Group 51c: Alternator Components



Item	Part No.	Description	Qty. Var. 3123
1	GM21521	Regulator	1
2	GM21522	Diode	1

Appendix A Common Hardware Identification

Screw/Bolts/Studs	
Head Styles	
Hex Head or Machine Head	
Hex Head or Machine Head with Washer	
Flat Head (FHM)	
Round Head (RHM)	
Pan Head	
Hex Socket Head Cap or Allen™ Head Cap	
Hex Socket Head or Allen™ Head Shoulder Bolt	
Sheet Metal Screw	
Stud	
Drive Styles	
Hex	
Hex and Slotted	
Phillips®	
Slotted	
Hex Socket	

Nuts	
Nut Styles	
Hex Head	
Lock or Elastic	
Square	
Cap or Acorn	
Wing	
Washers	
Washer Styles	
Plain	
Split Lock or Spring	
Spring or Wave	
External Tooth Lock	
Internal Tooth Lock	
Internal-External Tooth Lock	

Hardness Grades	
American Standard	
Grade 2	
Grade 5	
Grade 8	
Grade 8/9 (Hex Socket Head)	
Metric	
Number stamped on hardware; 5.8 shown	

Allen™ head screw is a trademark of Holo-Krome Co.

Phillips® screw is a registered trademark of Phillips Screw Company.

Sample Dimensions

American Standard (Screws, Bolts, Studs, and Nuts)

1/4-20 x 1

- Length In Inches (Screws and Bolts)
- Threads Per Inch
- Major Thread Diameter In Fractional Inches Or Screw Number Size

Metric (Screws, Bolts, Studs, and Nuts)

M8-1.25 x 20

- Length In Millimeters (Screws and Bolts)
- Distance Between Threads In Millimeters
- Major Thread Diameter In Millimeters

Plain Washers

9/32 x 5/8 x 1/16

- Thickness
- External Dimension
- Internal Dimension

Lock Washers

5/8

- Internal Dimension

Appendix B Common Hardware List

The Common Hardware List lists part numbers and dimensions for common hardware items.

American Standard

Part No.	Dimensions
Hex Head Bolts (Grade 5)	
X-465-17	1/4-20 x .38
X-465-6	1/4-20 x .50
X-465-2	1/4-20 x .62
X-465-16	1/4-20 x .75
X-465-18	1/4-20 x .88
X-465-7	1/4-20 x 1.00
X-465-8	1/4-20 x 1.25
X-465-9	1/4-20 x 1.50
X-465-10	1/4-20 x 1.75
X-465-11	1/4-20 x 2.00
X-465-12	1/4-20 x 2.25
X-465-14	1/4-20 x 2.75
X-465-21	1/4-20 x 5.00
X-465-25	1/4-28 x .38
X-465-20	1/4-28 x 1.00
X-125-33	5/16-18 x .50
X-125-23	5/16-18 x .62
X-125-3	5/16-18 x .75
X-125-31	5/16-18 x .88
X-125-5	5/16-18 x 1.00
X-125-24	5/16-18 x 1.25
X-125-34	5/16-18 x 1.50
X-125-25	5/16-18 x 1.75
X-125-26	5/16-18 x 2.00
230578	5/16-18 x 2.25
X-125-29	5/16-18 x 2.50
X-125-27	5/16-18 x 2.75
X-125-28	5/16-18 x 3.00
X-125-22	5/16-18 x 4.50
X-125-32	5/16-18 x 5.00
X-125-35	5/16-18 x 5.50
X-125-36	5/16-18 x 6.00
X-125-40	5/16-18 x 6.50
X-125-43	5/16-24 x 1.75
X-125-44	5/16-24 x 2.50
X-125-30	5/16-24 x .75
X-125-39	5/16-24 x 2.00
X-125-38	5/16-24 x 2.75
X-6238-2	3/8-16 x .62
X-6238-10	3/8-16 x .75
X-6238-3	3/8-16 x .88
X-6238-11	3/8-16 x 1.00
X-6238-4	3/8-16 x 1.25
X-6238-5	3/8-16 x 1.50
X-6238-1	3/8-16 x 1.75
X-6238-6	3/8-16 x 2.00
X-6238-17	3/8-16 x 2.25
X-6238-7	3/8-16 x 2.50
X-6238-8	3/8-16 x 2.75
X-6238-9	3/8-16 x 3.00
X-6238-19	3/8-16 x 3.25
X-6238-12	3/8-16 x 3.50
X-6238-20	3/8-16 x 3.75
X-6238-13	3/8-16 x 4.50
X-6238-18	3/8-16 x 5.50
X-6238-25	3/8-16 x 6.50

Part No.	Dimensions
Hex Head Bolts, cont.	
X-6238-14	3/8-24 x .75
X-6238-16	3/8-24 x 1.25
X-6238-21	3/8-24 x 4.00
X-6238-22	3/8-24 x 4.50
X-6024-5	7/16-14 x .75
X-6024-2	7/16-14 x 1.00
X-6024-8	7/16-14 x 1.25
X-6024-3	7/16-14 x 1.50
X-6024-4	7/16-14 x 2.00
X-6024-11	7/16-14 x 2.75
X-6024-12	7/16-14 x 6.50
X-129-15	1/2-13 x .75
X-129-17	1/2-13 x 1.00
X-129-18	1/2-13 x 1.25
X-129-19	1/2-13 x 1.50
X-129-20	1/2-13 x 1.75
X-129-21	1/2-13 x 2.00
X-129-22	1/2-13 x 2.25
X-129-23	1/2-13 x 2.50
X-129-24	1/2-13 x 2.75
X-129-25	1/2-13 x 3.00
X-129-27	1/2-13 x 3.50
X-129-29	1/2-13 x 4.00
X-129-30	1/2-13 x 4.50
X-463-9	1/2-13 x 5.50
X-129-44	1/2-13 x 6.00
X-129-51	1/2-20 x .75
X-129-45	1/2-20 x 1.25
X-129-52	1/2-20 x 1.50
X-6021-3	5/8-11 x 1.00
X-6021-4	5/8-11 x 1.25
X-6021-2	5/8-11 x 1.50
X-6021-1	5/8-11 x 1.75
273049	5/8-11 x 2.00
X-6021-5	5/8-11 x 2.25
X-6021-6	5/8-11 x 2.50
X-6021-7	5/8-11 x 2.75
X-6021-12	5/8-11 x 3.75
X-6021-11	5/8-11 x 4.50
X-6021-10	5/8-11 x 6.00
X-6021-9	5/8-18 x 2.50
X-6239-1	3/4-10 x 1.00
X-6239-8	3/4-10 x 1.25
X-6239-2	3/4-10 x 1.50
X-6239-3	3/4-10 x 2.00
X-6239-4	3/4-10 x 2.50
X-6239-5	3/4-10 x 3.00
X-6239-6	3/4-10 x 3.50
X-792-1	1-8 x 2.25
X-792-5	1-8 x 3.00
X-792-8	1-8 x 5.00

Part No.	Dimensions	Type
Hex Nuts		
X-6009-1	1-8	Standard
X-6210-3	6-32	Whiz
X-6210-4	8-32	Whiz
X-6210-5	10-24	Whiz
X-6210-1	10-32	Whiz
X-6210-2	1/4-20	Spiralock
X-6210-6	1/4-28	Spiralock
X-6210-7	5/16-18	Spiralock
X-6210-8	5/16-24	Spiralock
X-6210-9	3/8-16	Spiralock
X-6210-10	3/8-24	Spiralock
X-6210-11	7/16-14	Spiralock
X-6210-12	1/2-13	Spiralock
X-6210-15	7/16-20	Spiralock
X-6210-14	1/2-20	Spiralock
X-85-3	5/8-11	Standard
X-88-12	3/4-10	Standard
X-89-2	1/2-20	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
X-25-46	.125	.250	.022	#4
X-25-9	.156	.375	.049	#6
X-25-48	.188	.438	.049	#8
X-25-36	.219	.500	.049	#10
X-25-40	.281	.625	.065	1/4
X-25-85	.344	.687	.065	5/16
X-25-37	.406	.812	.065	3/8
X-25-34	.469	.922	.065	7/16
X-25-26	.531	1.062	.095	1/2
X-25-15	.656	1.312	.095	5/8
X-25-29	.812	1.469	.134	3/4
X-25-127	1.062	2.000	.134	1

Metric

Hex head bolts are hardness grade 8.8 unless noted.

Part No.	Dimensions
Hex Head Bolts (Partial Thread)	
M931-05055-60	M5-0.80 x 55
M931-06040-60	M6-1.00 x 40
M931-06055-60	M6-1.00 x 55
M931-06060-60	M6-1.00 x 60
M931-06060-SS	M6-1.00 x 60
M931-06070-60	M6-1.00 x 70
M931-06070-SS	M6-1.00 x 70
M931-06075-60	M6-1.00 x 75
M931-06090-60	M6-1.00 x 90
M931-06145-60	M6-1.00 x 145
M931-06150-60	M6-1.00 x 150
M931-08035-60	M8-1.25 x 35
M931-08040-60	M8-1.25 x 40
M931-08045-60	M8-1.25 x 45
M931-08050-60	M8-1.25 x 50
M931-08055-60	M8-1.25 x 55
M931-08055-82	M8-1.25 x 55*
M931-08060-60	M8-1.25 x 60
M931-08070-60	M8-1.25 x 70
M931-08070-82	M8-1.25 x 70*
M931-08075-60	M8-1.25 x 75
M931-08080-60	M8-1.25 x 80
M931-08090-60	M8-1.25 x 90
M931-08095-60	M8-1.25 x 95
M931-08100-60	M8-1.25 x 100
M931-08110-60	M8-1.25 x 110
M931-08120-60	M8-1.25 x 120
M931-08130-60	M8-1.25 x 130
M931-08140-60	M8-1.25 x 140
M931-08150-60	M8-1.25 x 150
M931-08200-60	M8-1.25 x 200
M931-10040-82	M10-1.25 x 40*
M931-10040-60	M10-1.50 x 40
M931-10045-60	M10-1.50 x 45
M931-10050-60	M10-1.50 x 50
M931-10050-82	M10-1.25 x 50*
M931-10055-60	M10-1.50 x 55
M931-10060-60	M10-1.50 x 60
M931-10065-60	M10-1.50 x 65
M931-10070-60	M10-1.50 x 70
M931-10080-60	M10-1.50 x 80
M931-10080-82	M10-1.25 x 80*
M931-10090-60	M10-1.50 x 90
M931-10090-82	M10-1.50 x 90*
M931-10100-60	M10-1.50 x 100
M931-10110-60	M10-1.50 x 110
M931-10120-60	M10-1.50 x 120
M931-10130-60	M10-1.50 x 130
M931-10140-60	M10-1.50 x 140
M931-10180-60	M10-1.50 x 180
M931-10235-60	M10-1.50 x 235
M931-10260-60	M10-1.50 x 260
M960-10330-60	M10-1.25 x 330
M931-12045-60	M12-1.75 x 45
M960-12050-60	M12-1.25 x 50
M960-12050-82	M12-1.25 x 50*
M931-12050-60	M12-1.75 x 50
M931-12050-82	M12-1.75 x 50*
M931-12055-60	M12-1.75 x 55
M931-12060-60	M12-1.75 x 60
M931-12060-82	M12-1.75 x 60*
M931-12065-60	M12-1.75 x 65
M931-12075-60	M12-1.75 x 75
M931-12080-60	M12-1.75 x 80
M931-12090-60	M12-1.75 x 90
M931-12100-60	M12-1.75 x 100
M931-12110-60	M12-1.75 x 110

Part No.	Dimensions
Hex Head Bolts (Partial Thread), continued	
M960-16090-60	M16-1.50 x 90
M931-16090-60	M16-2.00 x 90
M931-16100-60	M16-2.00 x 100
M931-16100-82	M16-2.00 x 100*
M931-16120-60	M16-2.00 x 120
M931-16150-60	M16-2.00 x 150
M931-20065-60	M20-2.50 x 65
M931-20090-60	M20-2.50 x 90
M931-20100-60	M20-2.50 x 100
M931-20120-60	M20-2.50 x 120
M931-20140-60	M20-2.50 x 140
M931-20160-60	M20-2.50 x 160
M931-22090-60	M22-2.50 x 90
M931-22120-60	M22-2.50 x 120
M931-22160-60	M22-2.50 x 160
M931-24090-60	M24-3.00 x 90
M931-24120-60	M24-3.00 x 120
M931-24160-60	M24-3.00 x 160
M931-24200-60	M24-3.00 x 200
Hex Head Bolts (Full Thread)	
M933-04006-60	M4-0.70 x 6
M933-05030-60	M5-0.80 x 30
M933-05035-60	M5-0.80 x 35
M933-05050-60	M5-0.80 x 50
M933-06010-60	M6-1.00 x 10
M933-06012-60	M6-1.00 x 12
M933-06014-60	M6-1.00 x 14
M933-06016-60	M6-1.00 x 16
M933-06020-60	M6-1.00 x 20
M933-06025-60	M6-1.00 x 25
M933-06030-60	M6-1.00 x 30
M933-06040-60	M6-1.00 x 40
M933-06050-60	M6-1.00 x 50
M933-07025-60	M7-1.00 x 25
M933-08010-60	M8-1.25 x 10
M933-08012-60	M8-1.25 x 12
M933-08016-60	M8-1.25 x 16
M933-08020-60	M8-1.25 x 20
M933-08025-60	M8-1.25 x 25
M933-08030-60	M8-1.25 x 30
M933-08030-82	M8-1.25 x 30*
M933-10012-60	M10-1.50 x 12
M961-10020-60	M10-1.25 x 20
M933-10020-60	M10-1.50 x 20
M933-10025-60	M10-1.50 x 25
M961-10025-60	M10-1.25 x 25
M933-10025-82	M10-1.50 x 25*
M961-10030-60	M10-1.25 x 30
M933-10030-60	M10-1.50 x 30
M933-10030-82	M10-1.50 x 30*
M961-10035-60	M10-1.25 x 35
M933-10035-60	M10-1.50 x 35
M933-10035-82	M10-1.50 x 35*
M961-10040-60	M10-1.25 x 40

Part No.	Dimensions
Hex Head Bolts (Full Thread), continued	
M933-12016-60	M12-1.75 x 16
M933-12020-60	M12-1.75 x 20
M961-12020-60F	M12-1.50 x 20
M933-12025-60	M12-1.75 x 25
M933-12025-82	M12-1.75 x 25*
M961-12030-60	M12-1.25 x 30
M933-12030-82	M12-1.75 x 30*
M961-12030-82F	M12-1.50 x 30*
M933-12030-60	M12-1.75 x 30
M933-12035-60	M12-1.75 x 35
M961-12040-82	M12-1.25 x 40*
M933-12040-60	M12-1.75 x 40
M933-12040-82	M12-1.75 x 40*
M961-14025-60	M14-1.50 x 25
M933-14025-60	M14-2.00 x 25
M961-14050-82	M14-1.50 x 50*
M961-16025-60	M16-1.50 x 25
M933-16025-60	M16-2.00 x 25
M961-16030-82	M16-1.50 x 30*
M933-16030-82	M16-2.00 x 30*
M933-16035-60	M16-2.00 x 35
M961-16040-60	M16-1.50 x 40
M933-16040-60	M16-2.00 x 40
M961-16045-82	M16-1.50 x 45*
M933-16045-82	M16-2.00 x 45*
M933-16050-60	M16-2.00 x 50
M933-16050-82	M16-2.00 x 50*
M933-16060-60	M16-2.00 x 60
M933-16070-60	M16-2.00 x 70
M933-18035-60	M18-2.50 x 35
M933-18050-60	M18-2.50 x 50
M933-18060-60	M18-2.50 x 60
M933-20050-60	M20-2.50 x 50
M933-20055-60	M20-2.50 x 55
M933-24060-60	M24-3.00 x 60
M933-24065-60	M24-3.00 x 65
M933-24070-60	M24-3.00 x 70
Pan Head Machine Screws	
M7985A-03010-20	M3-0.50 x 10
M7985A-03012-20	M3-0.50 x 12
M7985A-04010-20	M4-0.70 x 10
M7985A-04016-20	M4-0.70 x 16
M7985A-04020-20	M4-0.70 x 20
M7985A-04050-20	M4-0.70 x 50
M7985A-04100-20	M4-0.70 x 100
M7985A-05010-20	M5-0.80 x 10
M7985A-05012-20	M5-0.80 x 12
M7985A-05016-20	M5-0.80 x 16
M7985A-05020-20	M5-0.80 x 20
M7985A-05025-20	M5-0.80 x 25
M7985A-05030-20	M5-0.80 x 30
M7985A-05080-20	M5-0.80 x 80
M7985A-05100-20	M5-0.80 x 100
M7985A-06100-20	M6-1.00 x 100
Flat Head Machine Screws	
M965A-04012-SS	M4-0.70 x 12
M965A-05012-SS	M5-0.80 x 12
M965A-05016-20	M5-0.80 x 16
M965A-06012-20	M6-1.00 x 12

* This metric hex bolt's hardness is grade 10.9.

Metric, continued

Hex Nuts

Part No.	Dimensions	Type
M934-03-50	M3-0.50	Standard
M934-04-50	M4-0.70	Standard
M934-04-B	M4-0.70	Brass
M934-05-50	M5-0.80	Standard
M934-06-60	M6-1.00	Standard
M934-06-64	M6-1.00	Std. (green)
M6923-06-80	M6-1.00	Spiralock
M982-06-80	M6-1.00	Elastic Stop
M934-08-60	M8-1.25	Standard
M6923-08-80	M8-1.25	Spiralock
M982-08-80	M8-1.25	Elastic Stop
M934-10-60	M10-1.50	Standard
M934-10-60F	M10-1.25	Standard
M6923-10-80	M10-1.50	Spiralock
M6923-10-62	M10-1.50	Spiralock†
M982-10-80	M10-1.50	Elastic Stop
M934-12-60	M12-1.75	Standard
M934-12-60F	M12-1.25	Standard
M6923-12-80	M12-1.75	Spiralock
M982-12-80	M12-1.75	Elastic Stop
M982-14-60	M14-2.00	Elastic Stop
M6923-16-80	M16-2.00	Spiralock
M982-16-80	M16-2.00	Elastic Stop
M934-18-80	M18-2.5	Standard
M982-18-60	M18-2.50	Elastic Stop
M934-20-80	M20-2.50	Standard
M982-20-80	M20-2.50	Elastic Stop
M934-22-60	M22-2.50	Standard
M934-24-80	M24-3.00	Standard
M982-24-60	M24-3.00	Elastic Stop
M934-30-80	M30-3.50	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
M125A-03-80	3.2	7.0	0.5	M3
M125A-04-80	4.3	9.0	0.8	M4
M125A-05-80	5.3	10.0	1.0	M5
M125A-06-80	6.4	12.0	1.6	M6
M125A-08-80	8.4	16.0	1.6	M8
M125A-10-80	10.5	20.0	2.0	M10
M125A-12-80	13.0	24.0	2.5	M12
M125A-14-80	15.0	28.0	2.5	M14
M125A-16-80	17.0	30.0	3.0	M16
M125A-18-80	19.0	34.0	3.0	M18
M125A-20-80	21.0	37.0	3.0	M20
M125A-24-80	25.0	44.0	4.0	M24

† This metric hex nut's hardness is grade 8.

Service Parts

Industrial Generator Sets

Models:

Accessories

20-230 kW
Diesel-powered

ISO 9001
KOHLER POWER SYSTEMS
NATIONALLY REGISTERED

KOHLER®
POWER SYSTEMS

TP-6116 2/02c

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Introduction

This manual contains parts lists of optional accessory kits installed on Kohler diesel-powered industrial generator sets. This manual does not include controller, cooling, and some fuel system kits. See the chart below for parts catalogs containing parts lists of these kits.

Additional Generator Set Parts Catalogs

Generator Set Model	Parts Catalog Number
20-200ROZJREOZJ	TP-5408
135-200ROZJ (6081 only)	TP-5828
Controllers	TP-6009
20-170ROZK	TP-6029
200REOZP	TP-6048
20ROZJB/20-230REOZJB	TP-6142

How to Find Service Part Numbers

Follow the step-by-step instructions below to determine the correct service part number. An example is given with each step.

Example: Need new circuit breaker for the generator set safeguard breaker kit.

1. Determine the accessory kit number for the needed service part. Refer to the generator set nameplate to identify the kit number installed on your generator set. See Figure 1 for an example of the nameplate.

Example: 272748 Safeguard Breaker

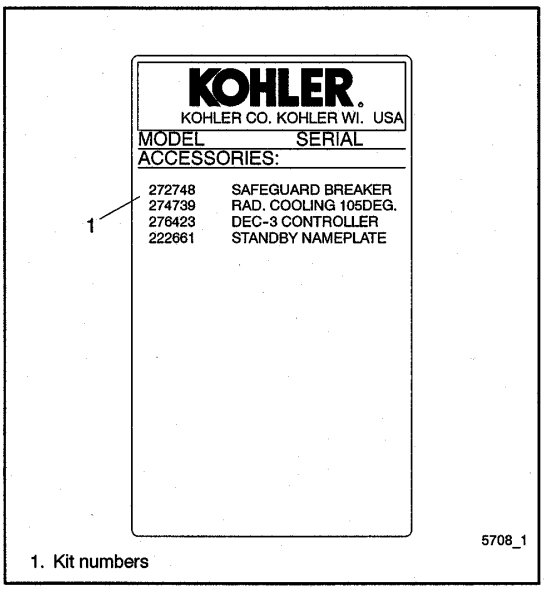

Figure 1 Generator Accessory Nameplate

2. Use the Index at the end of this catalog to find the location of the kit number in the Kit Parts List.

Example: Safeguard breaker kit 272748 is on page 41.

3. Locate the service part description in the list of parts following each kit. Read across to the part number.

Example: Circuit Breaker, 5 A, 240 V, 3 pole is part number X-796-6.

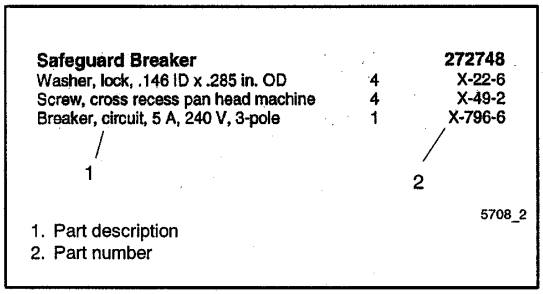
Safeguard Breaker 272748
Washer, lock, .146 ID x .285 in. OD 4 X-22-6
Screw, cross recess pan head machine 4 X-49-2
Breaker, circuit, 5 A, 240 V, 3-pole 1 X-796-6
1
2
5708_2
1. Part description
2. Part number

Figure 2 Kit Parts List

Kit Description/Number Sequence

This publication lists the kit names in alphabetical order and arranges kits numerically under the kit name.

Kit Parts List

Air Cleaner Restriction Indicator Kit

Description	Qty.	Part No.
Air Cleaner Restriction Indicator		**274608**
Fitting, 45deg. street elbow	1	267428
Gauge, restriction	1	273113
Coupling, pipe, 1/8 x 1 3/16 in.	1	X-216-24
Air Cleaner Restriction Indicator		**326237**
Gauge, restriction	1	273113
Air Cleaner Restriction Indicator		**328005**
Gauge, restriction	1	273113
Bushing, reducing, 1/8 x 3/8 in. NPT	1	D-228
Air Cleaner Restriction Indicator		**343513**
Gauge, restriction	1	273377
Air Cleaner Restriction Indicator		**GM10756-KA1**
Gauge, restriction	1	273113
Washer, nylon, .878 ID x 1.132 in. OD	1	276552
Adapter, bushing	1	360975
Air cleaner kit 20-2000 kW	1	TT-1207
Air Cleaner Restriction Indicator		**GM11490-KA1**
Fitting, 45deg. street elbow	1	267428
Gauge, restriction	1	GM11489
Air cleaner kit 20-2000 kW	1	TT-1207
Coupling, pipe, 1/8 x 1 3/16 in.	1	X-216-24
Air Cleaner Restriction Indicator		**GM11491-KA1**
Gauge, restriction	1	GM11489
Air cleaner kit 20-2000 kW	1	TT-1207

Alarm Kits, Inner Subbase Fuel Tank Leak

Description	Qty.	Part No.
Inner Tank Leak Alarm		**226203**
Bracket, support	1	224871
Insert, threaded	4	225948
Box	1	225949
Harness, wiring, leak alarm, 6-15 kW	1	226200
Harness, wiring, leak alarm, 200-400 kW	1	226207
Fuse, 5 A, 250 V	1	239298
Connector, plug, 4-position	1	239408
Connector, plug, 4-position	1	239408
Connector, jack, 4-position	1	239411
Connector, jack, 4-position	1	239411
Lens, red	1	253241
Switch, float, 1-pole	1	255600
Vibromount	3	259919
Fuse holder, inline	1	269216
Plate, silkscreen	1	276800
Screw, mounting	4	292828
Bracket, leak alarm	1	336505
Box assembly	1	A-224861
Sensor, leak	1	A-226201
Plate assembly	1	A-276799
PCB assembly, A/V 1-light annunciator	1	A-292883
Grommet, round	1	X-284-15
Screw, cross recess round machine	2	X-51-11
Spacer, .25 OD, .5 in.	4	X-712-9
Screw, hex washer head, drill	2	X-794-2

Description	Qty.	Part No.
Inner Tank Leak Alarm		**226204**
Bracket, support	1	224871
Insert, threaded	4	225948
Box	1	225949
Harness, wiring, leak alarm, 6-15 kW	1	226200
Harness, wiring, detector, 120 V	1	226208
Fuse, 5 A, 250 V	1	239298
Connector, plug, 4-position	1	239408
Connector, jack, 4-position	1	239411
Lens, red	1	253241
Switch, float, 1-pole	1	255600
Vibromount	3	259919
Fuse holder, inline	1	269216
Plate, silkscreen	1	276800
Screw, mounting	4	292828
Bracket, leak alarm	1	336505
Box assembly	1	A-224861
Sensor, leak	1	A-226201
Plate assembly	1	A-276799
PCB assembly, A/V 1-light annunciator	1	A-292883
Grommet, round	1	X-284-15
Screw, cross recess round machine	2	X-51-11
Spacer, .25 OD, .5 in.	4	X-712-9
Screw, hex washer head, drill	2	X-794-2
Low Fuel Level Alarm		**GM10409-KA1**
Wiring harness, float, switch	1	224856
Bracket, leak alarm	1	336505
Harness, low fuel level alarm	1	GM10397
Box, assembly	1	GM10407
Dwg, assembly low fuel alarm	1	GM10409
Nut, hex 4mm	2	M934-04-50

Alarm Kits, Subbase Tank Low Fuel

Description	Qty.	Part No.
Low Level Fuel Alarm		**224696**
Switch, low fuel level	1	224800
Harness, wiring, float, switch	1	224856
Low Level Fuel Alarm		**224697**
Switch, low fuel level	1	224801
Harness, wiring, float, switch	1	224856
Low Level Fuel Alarm		**224698**
Switch, low fuel level	1	224802
Harness, wiring, float, switch	1	224856
Low Fuel Level Switch		**292282**
Harness, wiring, float, switch	1	224856
Switch, low fuel level	1	292269
Low Fuel Level Switch		**292283**
Harness, wiring, float, switch	1	224856
Switch, low fuel level	1	292270
Low Fuel Level Switch		**292284**
Harness, wiring, float, switch	1	224856
Switch, low fuel	1	292271
Low Fuel Level Switch		**292285**
Harness, wiring, float, switch	1	224856
Switch, low fuel level	1	292272

Kit Parts List

Alarm Panel Kit, Remote Audio/Visual

Description	Qty.	Part No.
Remote A/V Alarm Panel		**GM17070-KP1**
Lens, red	1	253241
Screw	4	292828
Plate, silkscreened	1	292936
PCB assembly, A/V 1-light annunciator	1	A-292883
Plate assembly	1	A-292887
Customer connection assembly	1	GM13984
Diagram, accessory interconnection	1	GM16088
Harness, wiring controller connection	1	GM17033
AV alarm, gensets with 550 controller	1	TT-1300
Washer, lock, .172 ID x .333 in. OD	4	X-22-7
Screw, cross recess round head machine	6	X-51-3
Stud, self-clinching, 8-32 x .875 in.	4	X-6205-3
Nut, flange whiz, 8-32	6	X-6210-4
Spacer, .25 OD, .5 in.	4	X-712-9
Spacer, .25 OD, .5 in.	6	X-712-9
Nut, hex machine screw, 8-32	4	X-72-4
Remote Alarm		**PA-292856**
Lens, red	1	253241
Screw, mounting	4	292828
Plate, silkscreened	1	292936
PCB assembly, A/V 1-light annunciator	1	A-292883
Plate assembly	1	A-292887
Annunciator panel, 1-light	1	TT-639
Washer, lock, .172 ID x .333 in. OD	4	X-22-7
Spacer, .25 OD, .5 in.	4	X-712-9
Nut, hex machine screw, 8-32	4	X-72-4

Battery Charger Kits

Description	Qty.	Part No.
Battery Charger, 12 V, Float Equal.		**GM11849-KP1**
Battery charger, 12V-6A, float-equalize	1	GM11849
Battery Charger, 24 V, Float Equal.		**GM11850-KP1**
Battery charger, 24V-3A, float-equalize	1	GM11850

Description	Qty.	Part No.
Battery Charger		**PAA-326767**
Ring, lock switch	1	151511
Tab, ID "grd"	1	201620-152
Decal, connection	1	233966
Fuse, 5 A, 250 V	1	239298
Clip, speed	2	257442
Fuse, 25 A, 125 V	1	262389
Transformer, 120-240 V, 26.6 V	1	262395
Decal, warning connection	1	262397
Clip, cable	1	262399
Fuse holder	2	263156
Switch, toggle, 1 pole	1	268015
Spacer	8	287948
Lamp, 120 V, .33 W	1	291208
Decal	1	292387
Heatsink	1	292938
Strip, terminal	1	292940
Ammeter, 0-15 A, DC	1	292941
Module, SCR	1	292946
Resistor, .04/.05 ohm, 35 W	1	292947
Fuse, 7 A, 250 V	1	292948
Voltmeter, 0-50 V, DC	1	292957
Marker, strip	1	292961
Marker, strip	1	292962
Retainer	2	295010
Block, terminal	1	295314
Nut, captive, 6-32	4	298810
Box, battery charger	1	325593-SD
Nameplate, battery charger	1	325996
Wiring harness, engine, 18 kw relay	1	326780
Diagram, wiring	1	326782
Door, silkscreened, battery charger	1	326784
Charger, battery	1	A-326767
PCB assembly	1	B-262375
PCB assembly	1	C-262378
Charger, battery, automatic	1	TT-680
Charger, battery, circuit board	1	TT-729
Washer, lock, .262 ID x .469 in. OD	4	X-22-11
Washer, lock, .262 ID x .743 in. OD	4	X-22-12
Washer, lock, .172 ID x .595 in. OD	2	X-22-18
Washer, lock, .146 ID x .53 in. OD	3	X-22-25
Washer, lock, .146 ID x .285 in. OD	14	X-22-6
Terminal, ring, male, 16-14 AWG	2	X-283-1
Terminal, ring, male, 10-12 AWG	2	X-283-11
Terminal, ring, male, 16-14 AWG	3	X-283-2
Cable, tie	1	X-468-12
Screw, slotted pan head machine	16	X-49-25
Screw, slotted pan head machine	4	X-49-26
Screw, slotted pan head machine	3	X-49-39
Screw, cross recess pan head machine	2	X-49-6
Screw, slotted pan head machine	2	X-50-1
Screw, slotted pan head machine	2	X-50-3
Screw, cross recess round machine	2	X-51-11
Screw, cross recess pan head machine	2	X-51-15
Screw, slotted pan head machine	4	X-51-30
Screw, slotted round head machine	1	X-51-53
Tubing, heat shrink	1	X-6079-2
Tubing, heat shrink	2	X-6081-3
Screw, Phillips hex crimptite	2	X-6216-1
Nut, hex machine screw, 10-32	2	X-70-3
Nut, hex machine screw, 6-32	2	X-71-2

Kit Parts List

Description	Qty.	Part No.
Battery Charger, 12 Volt		**PAD-292862**
Decal, connection	1	233966
Fuse, 5 A, 250 V	1	239298
Connector, plug, 12-position	1	241605
Clip, speed	2	257442
Fuse, 25 A, 125 V	1	262389
Transformer, 120/240 V, 29.5 V	1	262394
Decal, warning connection	1	262397
Clip, cable	1	262399
Holder, fuse	2	263156
Spacer	4	287948
Lamp, 120 V, .33 W	1	291208
Decal	1	292387
Strip, terminal	1	292940
Ammeter, 0-15 A, DC	1	292941
Voltmeter, 0-25 V, DC	1	292942
Module, SCR	1	292945
Fuse, 7 A, 250 V	1	292948
Harness, wiring, 12/24 V float chargers	1	292958
Marker, strip	1	292961
Marker, strip	1	292962
Retainer	2	295010
Block, terminal	1	295314
Nut, captive, 6-32	4	298810
Box, battery charger	1	325593-SD
Door, silkscreen	1	325596
Nameplate, battery charger	1	325608
PCB assembly, battery charger control	1	C-262377
Charger assembly, battery	1	D-292862
Charger, battery, automatic	1	TT-680
Charger, battery, circuit board	1	TT-729
Washer, lock, .262 ID x .743 in. OD	4	X-22-12
Washer, lock, .172 ID x .595 in. OD	2	X-22-18
Washer, lock, .146 ID x .53 in. OD	3	X-22-25
Washer, lock, .146 ID x .285 in. OD	10	X-22-6
Screw, slotted pan head machine	8	X-49-25
Screw, slotted pan head machine	4	X-49-26
Screw, slotted pan head machine	3	X-49-39
Screw, cross recess pan head machine	2	X-49-6
Screw, slotted pan head machine	2	X-50-1
Screw, slotted pan head machine	2	X-50-3
Screw, cross recess round machine	2	X-51-11
Screw, cross recess pan head machine	2	X-51-15
Screw, slotted pan head machine	4	X-51-30
Screw, cross recess machine	1	X-51-9
Screw, Phillips hex crimptite	2	X-6216-1
Nut, hex machine screw, 6-32	2	X-71-2

Description	Qty.	Part No.
Battery Charger, 12 Volt		**PAD-292863**
Decal, connection	1	233966
Fuse, 5 A, 250 V	1	239298
Connector, plug, 12-position	1	241605
Clip, speed	2	257442
Fuse, 25 A, 125 V	1	262389
Transformer, 120/240 V, 29.5 V	1	262394
Decal, warning connection	1	262397
Clip, cable	1	262399
Holder, fuse	2	263156
Spacer	8	287948
Lamp, 120 V, .33 W	1	291208
Decal	1	292387
Strip, terminal	1	292940
Ammeter, 0-15 A, DC	1	292941
Voltmeter, 0-25 V, DC	1	292942
Module, SCR	1	292945
Fuse, 7 A, 250 V	1	292948
Harness, wiring, 12/24 V float chargers	1	292958
Marker, strip	1	292961
Marker, strip	1	292962
Retainer	2	295010
Block, terminal	1	295314
Nut, captive, 6-32	4	298810
Box, battery charger	1	325593-SD
Door, silkscreen	1	325596
Nameplate, battery charger	1	325609
PCB assembly, battery charger alarm	1	B-262374
PCB assembly, battery charger control	1	C-262377
Charger, assembly	1	D-292863
Charger, battery, automatic	1	TT-680
Washer, lock, .262 ID x .743 in. OD	4	X-22-12
Washer, lock, .172 ID x .595 in. OD	2	X-22-18
Washer, lock, .146 ID x .53 in. OD	3	X-22-25
Washer, lock, .146 ID x .285 in. OD	14	X-22-6
Screw, slotted pan head machine	16	X-49-25
Screw, slotted pan head machine	4	X-49-26
Screw, slotted pan head machine	3	X-49-39
Screw, cross recess pan head machine	2	X-49-6
Screw, slotted pan head machine	2	X-50-1
Screw, slotted pan head machine	2	X-50-3
Screw, cross recess round machine	2	X-51-11
Screw, cross recess pan head machine	2	X-51-15
Screw, slotted pan head machine	4	X-51-30
Screw, cross recess machine	1	X-51-9
Screw, Phillips hex crimptite	2	X-6216-1
Nut, hex machine screw, 6-32	2	X-71-2

Kit Parts List

Description	Qty.	Part No.
Battery Charger, 24 Volt		**PAD-292864**
Decal, connection	1	233966
Fuse, 5 A, 250 V	1	239298
Connector, plug, 12-position	1	241605
Clip, speed	2	257442
Fuse, 25 A, 125 V	1	262389
Transformer, 120-240 V, 26.6 V	1	262395
Decal, warning connection	1	262397
Clip, cable	1	262399
Holder, fuse	2	263156
Spacer	4	287948
Lamp, 120 V, .33 W	1	291208
Decal	1	292387
Strip, terminal	1	292940
Ammeter, 0-15 A, DC	1	292941
Module, SCR	1	292946
Fuse, 7 A, 250 V	1	292948
Voltmeter, 0-50 V, DC	1	292957
Harness, wiring, 12/24 V float chargers	1	292958
Marker, strip	1	292961
Marker, strip	1	292962
Retainer	2	295010
Block, terminal	1	295314
Nut, captive, 6-32	4	298810
Box, battery charger	1	325593-SD
Door, silkscreen	1	325596
Decal, battery charger, 3.5 x 5 in.	1	325607
PCB assembly	1	C-262378
Charger assembly, battery	1	D-292864
Charger, battery, automatic	1	TT-680
Washer, lock, .262 ID x .743 in. OD	4	X-22-12
Washer, lock, .172 ID x .595 in. OD	2	X-22-18
Washer, lock, .146 ID x .53 in. OD	3	X-22-25
Washer, lock, .146 ID x .285 in. OD	10	X-22-6
Screw, slotted pan head machine	8	X-49-25
Screw, slotted pan head machine	4	X-49-26
Screw, slotted pan head machine	3	X-49-39
Screw, cross recess pan head machine	2	X-49-6
Screw, slotted pan head machine	2	X-50-1
Screw, slotted pan head machine	2	X-50-3
Screw, cross recess round machine	2	X-51-11
Screw, cross recess pan head machine	2	X-51-15
Screw, slotted pan head machine	4	X-51-30
Screw, cross recess machine	1	X-51-9
Screw, Phillips hex crimptite	2	X-6216-1
Nut, hex machine screw, 6-32	2	X-71-2

Description	Qty.	Part No.
Battery Charger, 24 Volt		**PAD-292865**
Decal, connection	1	233966
Decal, warning connection	1	262397
Spacer	8	287948
Lamp, 120 V, .33 W	1	291208
Decal	1	292387
Strip, terminal	1	292940
Module, SCR	1	292946
Fuse, 7 A, 250 V	1	292948
Voltmeter, 0-50 V, DC	1	292957
Harness, wiring, 12/24 V float chargers	1	292958
Nut, captive, 6-32	4	298810
Door, silkscreen	1	325596
PCB assembly	1	B-262375
PCB assembly	1	C-262378
Charger assembly, battery	1	D-292865
Washer, lock, .262 ID x .743 in. OD	4	X-22-12
Washer, lock, .172 ID x .595 in. OD	2	X-22-18
Washer, lock, .146 ID x .53 in. OD	3	X-22-25
Washer, lock, .146 ID x .285 in. OD	14	X-22-6
Screw, slotted pan head machine	16	X-49-25
Screw, slotted pan head machine	4	X-49-26
Screw, slotted pan head machine	3	X-49-39
Screw, cross recess pan head machine	2	X-49-6
Screw, slotted pan head machine	2	X-50-1
Screw, cross recess round machine	2	X-51-11
Screw, cross recess pan head machine	2	X-51-15
Screw, slotted pan head machine	4	X-51-30
Screw, cross recess machine	1	X-51-9
Screw, Phillips hex crimptite	2	X-6216-1
Nut, hex machine screw, 6-32	2	X-71-2

Battery Heater Kit

Battery Heater, 12 V		**336828**
Heater, battery wrap	1	336814
Heater, battery pad	1	336827
Battery Heater, 24 V		**336830**
Heater, battery wrap	2	336814
Heater, battery pad	2	336826
Battery Heater, 24 V		**343286**
Heater, battery wrap	2	336814
Heater, battery pad	2	336827
Battery Heater 110-120 V		**352359**
Heater, battery wrap	1	336814
Heater, battery pad	1	336826
Battery Heater 110-120 V		**352667**
Heater, battery wrap	2	336814
Heater, battery pad	2	336825

Battery Kits, Starting

Battery, 12 V, 900cca, 1/12 V, Dry		**225290**
Battery, dry charge	1	225289
Battery, 12 V, 900cca, 1/12 V, Wet		**256985**
Battery, wet charge	1	256984
Battery		**324493**
Battery	2	324367
Battery		**324494**
Battery	2	324368
Battery		**324588**
Battery, wet charge	2	324586

Kit Parts List

Description	Qty.	Part No.
Battery		**324589**
Battery, dry charge	2	324587
Battery		**336070**
Battery, dry charge	2	225289
Battery		**336071**
Battery, wet charge	2	256984
Battery		**336692**
Battery, wet charge	1	324586
Battery		**336693**
Battery, dry charge	1	324587

Blanket Kits, Exhaust Manifold

Exhaust Manifold Blanket		**275477**
Blanket, insulating, manifold	1	275480
Exhaust Manifold Blanket		**275478**
Blanket, insulating, manifold	1	275482
Blanket, insulating, manifold	1	275485
Blanket, insulating, turbo	1	276547
Blanket, insulating, elbow	1	276548
Exhaust Manifold Blanket		**275479**
Blanket, insulating, manifold	1	275517
Blanket, insulating, manifold	1	275518
Blanket, insulating, turbo wrap	1	275519
Blanket, insulating, elbow	1	276562
Blanket, insulating, manifold	1	276563
Exhaust Manifold Blanket		**275483**
Blanket, insulating, manifold	1	275481
Blanket, insulating, elbow	1	275484
Blanket, insulating, manifold	1	275486
Blanket, insulating, turbo	1	276523
Blanket, insulating, manifold	1	276989
Exhaust Manifold Blanket		**276558**
Blanket, insulating, turbo wrap	1	275519
Blanket, insulating, manifold	1	276559
Blanket, insulating, manifold	1	276560
Blanket, insulating, elbow	1	276562
Insulating blanket	1	276564
Exhaust Manifold Blanket		**GM10220-KA1**
Blanket, exhaust manifold	1	GM10223
Exhaust Manifold Blanket		**GM21241-KA1**
Exhaust blanket	1	GM21037
Exhaust Manifold & Turbo Blanket		**GM21241-KA2**
Exhaust blanket	1	GM21242

Breaker Kits, Circuit in NEMA Type 1

Line Circuit Breaker		**PA-253176**
Breaker, circuit, 500 A, 600 V, 3-pole	1	290861
Line Circuit Breaker		**PA-279878**
Breaker, circuit, 600 A, 600 V, 3-pole	1	291441
Line Circuit Breaker		**PA-279879**
Breaker, circuit, 700 A, 600 V, 3-pole	1	290862
Line Circuit Breaker		**PA-279880**
Breaker, circuit, 800 A, 600 V, 3-pole	1	290863
Line Circuit Breaker		**PA-279881**
Breaker, circuit, 900 A, 600 V, 3-pole	1	290933
Line Circuit Breaker		**PA-279882**
Breaker, circuit, 1000A, 600 V, 3-pole	1	280991
Line Circuit Breaker		**PA-279883**
Breaker, circuit, 1200 A, 600 V, 3-pole	1	291285

Description	Qty.	Part No.
Line Circuit Breaker		**PA-279884**
Breaker, circuit, 1400 A, 600 V, 3-pole	1	291111
Line Circuit Breaker		**PA-279885**
Breaker, circuit, 1600 A, 600 V, 3-pole	1	291668
Line Circuit Breaker		**PA-279886**
Breaker, circuit, 1800 A, 600 V, 3-pole	1	291733
Line Circuit Breaker		**PA-279887**
Breaker, circuit, 200 A, 600 V, 3-pole	1	282050
Line Circuit Breaker		**PA-279888**
Breaker, circuit, 2500 A, 600 V, 3-pole	1	282048
Line Circuit Breaker		**PA-279890**
Breaker, circuit, 500 A, 600 V, 3-pole	1	274543
Line Circuit Breaker		**PA-279891**
Breaker, circuit, 600 A, 600 V, 3-pole	1	274544
Line Circuit Breaker		**PA-279892**
Breaker, circuit, 700 A, 600 V, 3-pole	1	274489
Line Circuit Breaker		**PA-279893**
Breaker, circuit, 800 A, 600 V, 3-pole	1	274490
Line Circuit Breaker		**PA-279894**
Breaker, circuit, 900 A, 600 V, 3-pole	1	274491
Line Circuit Breaker		**PA-279895**
Breaker, circuit, 1000 A, 600 V, 3-pole	1	274492
Line Circuit Breaker		**PA-279896**
Breaker, circuit, 1200 A, 600 V, 3-pole	1	274493
Line Circuit Breaker		**PA-279897**
Breaker, circuit, 1400 A, 600 V, 3-pole	1	274494
Line Circuit Breaker		**PA-279898**
Breaker, circuit, 1600 A, 600 V, 3-pole	1	274533
Line Circuit Breaker		**PA-279899**
Breaker, circuit, 2000 A, 600 V, 3-pole	1	274534
Line Circuit Breaker		**PA-279900**
Breaker, circuit, 2500 A, 600 V, 3-pole	1	274535

Breaker Kits, Line Circuit

Line Circuit Breaker		**334001**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 225 A, 600 V, 3-pole	1	X-6304-16
Line Circuit Breaker		**334002**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 225 A, 600 V, 3-pole	1	X-6304-16

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334003**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222949-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-88
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334004**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222950-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-88
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334005**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 150 A, 600 V, 3-pole	1	X-6304-11
Line Circuit Breaker		**334006**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 150 A, 600 V, 3-pole	1	X-6304-11

Description	Qty.	Part No.
Line Circuit Breaker		**334008**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222949-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 400 A, 240 V, 3-pole	1	X-6304-6
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334009**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222950-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 400 A, 240 V, 3-pole	1	X-6304-6
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334011**
Cover, side	1	222974-BLK
Breaker, circuit, 40 A, 600 V, 3-pole	1	269252
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334012**
Cover, side	1	222974-BLK
Breaker, circuit, 60 A, 600 V, 3-pole	1	253224
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334013**
Cover, side	1	222974-BLK
Breaker, circuit, 80 A, 480 V, 3-pole	1	253225
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334014**
Cover, side	1	222974-BLK
Breaker, circuit, 100 A, 480 V, 3-pole	1	253226
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334015**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM10527-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Terminal, fast-on, male, # 2 AWG	1	X-251-17
Screw, cross recess pan head machine	2	X-51-45
Screw, slotted pan head machine	2	X-51-47
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 150 A, 240 V, 3-pole	1	X-6304-1

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334016**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM10527-BLK
Decal, power breaker	1	GM15301
Screw, slotted pan head machine	4	X-51-47
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-54
Line Circuit Breaker		**334017**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Decal, power breaker	1	GM15301
Screw, slotted pan head machine	4	X-51-47
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-57
Line Circuit Breaker		**334018**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Decal, power breaker	1	GM15301
Screw, slotted pan head machine	4	X-51-47
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-57
Line Circuit Breaker		**334019**
Cover, side	1	222974-BLK
Breaker, circuit, 50 A, 600 V, 3-pole	1	258928
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334020**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM10527-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Terminal, fast-on, male, # 4 AWG	1	X-251-16
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A, 600 V, 3-pole	1	X-6304-8

Description	Qty.	Part No.
Line Circuit Breaker		**334021**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM10527-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, cross recess pan head machine	2	X-51-45
Screw, slotted pan head machine	2	X-51-47
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 175 A, 240 V, 3-pole	1	X-6304-2
Line Circuit Breaker		**334022**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222949-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 350 A, 240 V, 3-pole	1	X-6304-4
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334023**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222950-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 350 A, 240 V, 3-pole	1	X-6304-4
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334024**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A, 600 V, 3-pole	1	X-6304-8

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334025**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A, 600 V, 3-pole	1	X-6304-8
Line Circuit Breaker		**334026**
Cover, side	1	222974-BLK
Breaker, circuit, 30 A, 600 V, 3-pole	1	269250
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334027**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222950-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-92
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334028**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 200 A, 600 V, 3-pole	1	X-6304-13
Line Circuit Breaker		**334029**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-85

Description	Qty.	Part No.
Line Circuit Breaker		**334030**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM10527-BLK
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, cross recess pan head machine	2	X-51-45
Screw, slotted pan head machine	2	X-51-47
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 225 A, 240 V, 3-pole	1	X-6304-3
Line Circuit Breaker		**334032**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 225 A, 600 V, 3-pole	1	X-6304-15
Line Circuit Breaker		**334033**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222949-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 225 A, 600 V, 3-pole	1	X-6304-15
Line Circuit Breaker		**334034**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222949-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 300 A, 600 V, 3-pole	1	X-6304-18
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334035**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222950-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-89
Screw, slotted pan head machine	4	X-6308-1

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Description	Qty.	Part No.
Line Circuit Breaker		**334036**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 150 A, 600 V, 3-pole	1	X-6304-10
Line Circuit Breaker		**334037**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222949-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 150 A, 600 V, 3-pole	1	X-6304-10
Line Circuit Breaker		**334038**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	360970-BLK
Bus, line	3	365606
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-104
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker		**334039**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222949-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 400 A, 240 V, 3-pole	1	X-6304-7
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334040**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222950-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 400 A, 240 V, 3-pole	1	X-6304-7
Screw, slotted pan head machine	4	X-6308-1

Description	Qty.	Part No.
Line Circuit Breaker		**334041**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM10527-BLK
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Terminal, fast-on, male, # 2 AWG	1	X-251-17
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 150 A, 600 V, 3-pole	1	X-6304-10
Line Circuit Breaker		**334042**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM10527-BLK
Screw, slotted pan head machine	4	X-51-47
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-55
Line Circuit Breaker		**334043**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Screw, slotted pan head machine	4	X-51-47
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-58
Line Circuit Breaker		**334044**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Screw, slotted pan head machine	4	X-51-47
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-58
Line Circuit Breaker		**334045**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM10527-BLK
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 175 A, 600 V, 3-pole	1	X-6304-12

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334046**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222949-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 350 A, 240 V, 3-pole	1	X-6304-5
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334047**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222950-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 350 A, 240 V, 3-pole	1	X-6304-5
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334048**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A, 600 V, 3-pole	1	X-6304-9
Line Circuit Breaker		**334049**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222949-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A, 600 V, 3-pole	1	X-6304-9
Line Circuit Breaker		**334050**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 200 A, 600 V, 3-pole	1	X-6304-14

Description	Qty.	Part No.
Line Circuit Breaker		**334051**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-86
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334052**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM10527-BLK
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 225 A, 600 V, 3-pole	1	X-6304-15
Line Circuit Breaker		**334053**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM10527-BLK
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Terminal, fast-on, male, # 4 AWG	1	X-251-16
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A, 600 V, 3-pole	1	X-6304-9
Line Circuit Breaker		**334054**
Cover, side	1	222976-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 40 A, 600 V, 4-pole	1	X-6250-2
Line Circuit Breaker		**334055**
Cover, side	1	222976-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 60 A, 600 V, 4-pole	1	X-6250-3
Line Circuit Breaker		**334056**
Cover, side	1	222976-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 80 A, 480 V, 4-pole	1	X-6250-4
Line Circuit Breaker		**334057**
Cover, side	1	222976-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 100 A, 480 V, 4-pole	1	X-6250-5
Line Circuit Breaker		**334058**
Cover, side	1	222976-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 50 A, 600 V, 4-pole	1	X-6250-6
Line Circuit Breaker		**334059**
Cover, side	1	222976-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 30 A, 600 V, 4-pole	1	X-6250-1

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334062**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Cover, side	1	352293-BLK
Tag, ground	1	354518
Terminal, fast-on, male, # 4 AWG	1	X-251-16
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-96
Line Circuit Breaker		**334063**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-96
Line Circuit Breaker		**334064**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-96
Line Circuit Breaker		**334065**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352326-BLK
Tag, ground	1	354518
Bus, line	3	364511
Bus, line	3	GM10168
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-120
Line Circuit Breaker		**334066**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Bus, line	3	364510
Bus, line	3	GM10167
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-111

Description	Qty.	Part No.
Line Circuit Breaker		**334067**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Bus, line	3	364510
Bus, line	3	GM10167
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-117
Line Circuit Breaker		**334069**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352326-BLK
Tag, ground	1	354518
Bus, line	3	364511
Bus, line	3	GM10168
Bus, line	3	GM10169
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-125
Line Circuit Breaker		**334070**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Cover, side	1	352293-BLK
Tag, ground	1	354518
Terminal, fast-on, male, # 4 AWG	1	X-251-16
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-97
Line Circuit Breaker		**334071**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-97
Line Circuit Breaker		**334072**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-97

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334073**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Bus, line	3	364510
Bus, line	3	GM10167
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-112
Line Circuit Breaker		**334074**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Bus, line	3	364510
Bus, line	3	GM10167
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-118
Line Circuit Breaker		**334075**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	360970-BLK
Bus, line	3	365606
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-109
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker		**334076**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352326-BLK
Tag, ground	1	354518
Bus, line	3	364511
Bus, line	3	GM10168
Bus, line	3	GM10169
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-125

Description	Qty.	Part No.
Line Circuit Breaker		**334078**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	360970-BLK
Bus, line	3	365606
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-103
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker		**334079**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352326-BLK
Tag, ground	1	354518
Bus, line	3	364511
Bus, line	3	GM10168
Bus, line	3	GM10169
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-124
Line Circuit Breaker		**334080**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	360970-BLK
Bus, line	3	365606
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-108
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker		**334081**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352326-BLK
Tag, ground	1	354518
Bus, line	3	364511
Bus, line	3	GM10168
Bus, line	3	GM10169
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-124
Line Circuit Breaker		**334082**
Cover, side	1	222995-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Breaker, circuit, 200 A, 600 V, 3-pole	1	X-6304-13

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334083**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352324-BLK
Bus, line	3	GM10411
Bus, line	3	GM10412
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-111
Line Circuit Breaker		**334084**
Cover, side	1	222995-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Breaker, circuit, 225 A, 600 V, 3-pole	1	X-6304-16
Line Circuit Breaker		**334085**
Cover, side	1	222995-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Breaker, circuit	1	X-6304-85
Line Circuit Breaker		**334086**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352324-BLK
Bus, line	3	GM10411
Bus, line	3	GM10412
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-117
Line Circuit Breaker		**334087**
Cover, side	1	222995-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Breaker, circuit	1	X-6304-85
Line Circuit Breaker		**334088**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352324-BLK
Bus, line	3	GM10411
Bus, line	3	GM10412
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-117
Line Circuit Breaker		**334089**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-88
Screw, slotted pan head machine	4	X-6308-1

Description	Qty.	Part No.
Line Circuit Breaker		**334090**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-88
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334091**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-92
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334092**
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Bus, line	3	GM10413
Bus, line	3	GM10414
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-120
Line Circuit Breaker		**334093**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-92
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334094**
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Bus, line	3	GM10413
Bus, line	3	GM10414
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-120
Line Circuit Breaker		**334095**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit, 400 A, 240 V, 3-pole	1	X-6304-6
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334096**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-96
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334097**
Insulator	2	290020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Bus, line	3	GM10413
Bus, line	3	GM10414
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-120

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334098**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Bus, line	3	365608
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-103
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334099**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Bus, line	3	GM10413
Bus, line	3	GM10414
Bus, line	3	GM10415
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-124
Line Circuit Breaker		**334100**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-103
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334101**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Bus, line	3	GM10413
Bus, line	3	GM10414
Bus, line	3	GM10415
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-124
Line Circuit Breaker		**334102**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-108
Line Circuit Breaker		**334103**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Bus, line	3	GM10413
Bus, line	3	GM10414
Bus, line	3	GM10415
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-124
Line Circuit Breaker		**334104**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-111

Description	Qty.	Part No.
Line Circuit Breaker		**334105**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222998
Insulator	2	290020
Tag, hang	1	336020
Bus, line	3	365608
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-136
Line Circuit Breaker		**334106**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-111
Line Circuit Breaker		**334107**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222998
Insulator	2	290020
Tag, hang	1	336020
Bus, line	3	365608
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-136
Line Circuit Breaker		**334108**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-116
Line Circuit Breaker		**334109**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365609
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Screw, HC (special thread length)	6	GM16793
Washer, spring, .46 ID x .875 in. OD	6	X-6086-20
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6304-119
Nut, hex, 7/16-14	6	X-70-13
Line Circuit Breaker		**334110**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222998
Insulator	2	290020
Tag, hang	1	336020
Bus, line	3	365609
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-139
Line Circuit Breaker		**334111**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365609
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Screw, HC (special thread length)	6	GM16793
Washer, spring, .46 ID x .875 in. OD	6	X-6086-20
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6304-121
Nut, hex, 7/16-14	6	X-70-13

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334112**
Bracket, circuit breaker	1	222999
Insulator	4	290020
Cover, side	1	360973-BLK
Bus, line	3	365609
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-125
Line Circuit Breaker		**334113**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222998
Insulator	2	290020
Tag, hang	1	336020
Bus, line	3	365609
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-141
Line Circuit Breaker		**334114**
Cover, side	1	222995-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Breaker, circuit, 200 A, 600 V, 3-pole	1	X-6304-14
Line Circuit Breaker		**334115**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352324-BLK
Bus, line	3	GM10411
Bus, line	3	GM10412
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-112
Line Circuit Breaker		**334116**
Cover, side	1	222995-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Breaker, circuit, 225 A, 600 V, 3-pole	1	X-6304-15
Line Circuit Breaker		**334117**
Cover, side	1	222995-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Breaker, circuit	1	X-6304-86
Line Circuit Breaker		**334118**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352324-BLK
Bus, line	3	GM10411
Bus, line	3	GM10412
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-118
Line Circuit Breaker		**334119**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-89
Screw, slotted pan head machine	4	X-6308-1

Description	Qty.	Part No.
Line Circuit Breaker		**334120**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-93
Line Circuit Breaker		**334121**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Bus, line	3	GM10413
Bus, line	3	GM10414
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-121
Line Circuit Breaker		**334122**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit, 400 A, 240 V, 3-pole	1	X-6304-7
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334123**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-104
Line Circuit Breaker		**334124**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Bus, line	3	GM10413
Bus, line	3	GM10414
Bus, line	3	GM10415
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-125
Line Circuit Breaker		**334125**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-109
Line Circuit Breaker		**334126**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Bus, line	3	GM10413
Bus, line	3	GM10414
Bus, line	3	GM10415
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-125
Line Circuit Breaker		**334127**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-112

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334128**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222998
Insulator	2	290020
Tag, hang	1	336020
Bus, line	3	365608
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-137
Line Circuit Breaker		**334129**
Cover, side	1	222995-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Decal, power breaker	1	GM15301
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Breaker, circuit	1	X-6304-87
Line Circuit Breaker		**334130**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352324-BLK
Bus, line	3	GM10411
Bus, line	3	GM10412
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-119
Line Circuit Breaker		**334131**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-90
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334132**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Bus, line	3	GM10413
Bus, line	3	GM10414
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-122
Line Circuit Breaker		**334133**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-94
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334134**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Bus, line	3	GM10413
Bus, line	3	GM10414
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-122

Description	Qty.	Part No.
Line Circuit Breaker		**334135**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222999
Insulator	2	290020
Bus, line	3	360763
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-98
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334136**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-122
Line Circuit Breaker		**334137**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-105
Line Circuit Breaker		**334138**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-126
Line Circuit Breaker		**334139**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-110
Line Circuit Breaker		**334140**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6606-126
Line Circuit Breaker		**334141**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-113
Line Circuit Breaker		**334142**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222998
Insulator	2	290020
Tag, hang	1	336020
Bus, line	3	365608
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-138

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334143**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-117
Line Circuit Breaker		**334144**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222998
Insulator	2	290020
Tag, hang	1	336020
Bus, line	3	365608
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-138
Line Circuit Breaker		**334145**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365609
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Screw, HC (special thread length)	6	GM16793
Washer, spring, .46 ID x .875 in. OD	6	X-6086-20
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6304-120
Nut, hex, 7/16-14	6	X-70-13
Line Circuit Breaker		**334146**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222998
Insulator	2	290020
Tag, hang	1	336020
Bus, line	3	365609
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-140
Line Circuit Breaker		**334147**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365609
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Screw, HC (special thread length)	6	GM16793
Washer, spring, .46 ID x .875 in. OD	6	X-6086-20
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6304-122
Nut, hex, 7/16-14	6	X-70-13
Line Circuit Breaker		**334149**
Bracket, circuit breaker	1	222999
Insulator	4	290020
Cover, side	1	360973-BLK
Bus, line	3	365609
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-126
Line Circuit Breaker		**334150**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222998
Insulator	2	290020
Tag, hang	1	336020
Bus, line	3	365609
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-142

Description	Qty.	Part No.
Line Circuit Breaker		**334151**
Bracket, circuit breaker	1	222999
Cover, side	1	360973-BLK
Bus, line	3	365608
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Breaker, circuit	1	X-6304-108
Line Circuit Breaker		**334358**
Cover, side	1	222974-BLK
Breaker, circuit, 70 A, 600 V, 3-pole	1	258381
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334359**
Cover, side	1	222976-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 70 A, 600 V, 4-pole	1	X-6250-8
Line Circuit Breaker		**334453**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Cover, side	1	352293-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A	1	X-6306-99
Line Circuit Breaker		**334454**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Cover, side	1	352293-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker circuit 125 A	1	X-6306-100
Line Circuit Breaker		**334455**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Cover, side	1	352293-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-102
Line Circuit Breaker		**334456**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Cover, side	1	352293-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-103

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334457**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Cover, side	1	352293-BLK
Tag, ground	1	354518
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-111
Line Circuit Breaker		**334458**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Cover, side	1	352293-BLK
Tag, ground	1	354518
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-112
Line Circuit Breaker		**334459**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Cover, side	1	352293-BLK
Tag, ground	1	354518
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-117
Circuit Breaker		**334460**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Cover, side	1	352293-BLK
Tag, ground	1	354518
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-118
Line Circuit Breaker		**334463**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A	1	X-6306-99

Description	Qty.	Part No.
Line Circuit Breaker		**334464**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit 125 A	1	X-6306-100
Line Circuit Breaker		**334465**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-102
Line Circuit Breaker		**334466**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-103
Line Circuit Breaker		**334469**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-117
Line Circuit Breaker		**334470**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352295-BLK
Tag, ground	1	354518
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-118

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334471**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352294-BLK
Tag, ground	1	354518
Bus, line	3	364511
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-120
Line Circuit Breaker		**334472**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352294-BLK
Tag, ground	1	354518
Bus, line	3	364511
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-121
Line Circuit Breaker		**334473**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352326-BLK
Tag, ground	1	354518
Bus, line	3	364511
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-120
Line Circuit Breaker		**334474**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Cover, side	1	352326-BLK
Tag, ground	1	354518
Bus, line	3	364511
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-121
Line Circuit Breaker		**334480**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352324-BLK
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-117
Line Circuit Breaker		**334481**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352324-BLK
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-118

Description	Qty.	Part No.
Line Circuit Breaker		**334483**
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-120
Line Circuit Breaker		**334484**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Cover, side	1	352325-BLK
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-121
Circuit Breaker		**334642**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Cover, side	1	222950-BLK
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	360763
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-93
Screw, slotted pan head machine	4	X-6308-1
Line Circuit Breaker		**334718**
Breaker, circuit, 30 A, 600 V, 3-pole	1	269250
Cover, side	1	364489
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334719**
Cover, side	1	364490
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 30 A, 600 V, 4-pole	1	X-6250-1
Line Circuit Breaker		**334720**
Breaker, circuit, 40 A, 600 V, 3-pole	1	269252
Cover, side	1	364489
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334721**
Cover, side	1	364490
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 40 A, 600 V, 4-pole	1	X-6250-2
Line Circuit Breaker		**334722**
Breaker, circuit, 50 A, 600 V, 3-pole	1	258928
Cover, side	1	364489
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334723**
Cover, side	1	364490
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 50 A, 600 V, 4-pole	1	X-6250-6
Line Circuit Breaker		**334724**
Breaker, circuit, 60 A, 600 V, 3-pole	1	253224
Cover, side	1	364489
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334725**
Cover, side	1	364490
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 60 A, 600 V, 4-pole	1	X-6250-3
Line Circuit Breaker		**334726**
Breaker, circuit, 70 A, 600 V, 3-pole	1	258381
Cover, side	1	364489
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334727**
Cover, side	1	364490
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 70 A, 600 V, 4-pole	1	X-6250-8

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334728**
Breaker, circuit, 80 A, 480 V, 3-pole	1	253225
Cover, side	1	364489
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334729**
Cover, side	1	364490
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 80 A, 480 V, 4-pole	1	X-6250-4
Line Circuit Breaker		**334730**
Breaker, circuit, 90 A, 480 V, 3-pole	1	344905
Cover, side	1	364489
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334731**
Cover, side	1	364490
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit (with shunt trip)	1	X-6250-16
Line Circuit Breaker		**334732**
Breaker, circuit, 100 A, 480 V, 3-pole	1	253226
Cover, side	1	364489
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334733**
Cover, side	1	364490
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 100 A, 480 V, 4-pole	1	X-6250-5
Line Circuit Breaker		**334734**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Nut, hex 4mm	4	M934-04-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-51
Line Circuit Breaker		**334735**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Nut, hex 4mm	4	M934-04-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-52
Line Circuit Breaker		**334736**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Nut, hex 4mm	4	M934-04-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-54

Description	Qty.	Part No.
Line Circuit Breaker		**334737**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Nut, hex 4mm	4	M934-04-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-55
Line Circuit Breaker		**334738**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Nut, hex 4mm	4	M934-04-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-57
Line Circuit Breaker		**334739**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Nut, hex 4mm	4	M934-04-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-58
Line Circuit Breaker		**334740**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-61
Line Circuit Breaker		**334741**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-62

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334742**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-65
Line Circuit Breaker		**334743**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-66
Line Circuit Breaker		**334744**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-69
Line Circuit Breaker		**334745**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-70
Line Circuit Breaker		**334746**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-74

Description	Qty.	Part No.
Line Circuit Breaker		**334747**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-75
Line Circuit Breaker		**334748**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-78
Line Circuit Breaker		**334749**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-79
Line Circuit Breaker		**334750**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-82
Line Circuit Breaker		**334751**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364491
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-83

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334752**
Breaker, circuit, 80 A, 480 V, 3-pole	1	253225
Cover, side	1	364492-BLK
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334753**
Cover, side	1	364493-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 80 A, 480 V, 4-pole	1	X-6250-4
Line Circuit Breaker		**334754**
Breaker, circuit, 90 A, 480 V, 3-pole	1	344905
Cover, side	1	364492-BLK
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334755**
Cover, side	1	364493-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit (with shunt trip)	1	X-6250-16
Line Circuit Breaker		**334756**
Breaker, circuit, 100 A, 480 V, 3-pole	1	253226
Cover, side	1	364492-BLK
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**334757**
Cover, side	1	364493-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 100 A, 480 V, 4-pole	1	X-6250-5
Line Circuit Breaker		**334758**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Nut, hex 4mm	4	M934-04-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-54
Line Circuit Breaker		**334759**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Nut, hex 4mm	4	M934-04-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-55
Line Circuit Breaker		**334760**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Nut, hex 4mm	4	M934-04-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-57

Description	Qty.	Part No.
Line Circuit Breaker		**334761**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Nut, hex 4mm	4	M934-04-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-58
Line Circuit Breaker		**334762**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-61
Line Circuit Breaker		**334763**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-62
Line Circuit Breaker		**334764**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-65
Line Circuit Breaker		**334765**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-66

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334766**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-69
Line Circuit Breaker		**334767**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-70
Line Circuit Breaker		**334768**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-74
Line Circuit Breaker		**334769**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-75
Line Circuit Breaker		**334770**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-78

Description	Qty.	Part No.
Line Circuit Breaker		**334771**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-79
Line Circuit Breaker		**334772**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-82
Line Circuit Breaker		**334773**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-83
Line Circuit Breaker		**334774**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364495-BLK
Bus, line	3	364508
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-88
Line Circuit Breaker		**334775**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364495-BLK
Bus, line	3	364508
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-89

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334776**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364495-BLK
Bus, line	3	364508
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-92
Line Circuit Breaker		**334777**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364495-BLK
Bus, line	3	364508
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-93
Line Circuit Breaker		**334778**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364495-BLK
Bus, line	3	364508
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-96
Line Circuit Breaker		**334779**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364495-BLK
Bus, line	3	364508
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-97
Line Circuit Breaker		**334780**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364496
Bus, line	3	364509
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-100
Screw, pan head machine	4	X-6308-2

Description	Qty.	Part No.
Line Circuit Breaker		**334781**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364496
Bus, line	3	364509
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-101
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker		**334782**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364496
Bus, line	3	364509
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-103
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker		**334783**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364496
Bus, line	3	364509
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-104
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker		**334784**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364496
Bus, line	3	364509
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-108
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker		**334785**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364496
Bus, line	3	364509
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-109
Screw, pan head machine	4	X-6308-2

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334786**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364496
Bus, line	3	364509
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-111
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker		**334787**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bus, load	1	324313
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364496
Bus, line	3	364509
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-112
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker		**334788**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-93
Line Circuit Breaker		**334789**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-94
Line Circuit Breaker		**334790**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-96

Description	Qty.	Part No.
Line Circuit Breaker		**334791**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-97
Line Circuit Breaker		**334792**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A	1	X-6306-99
Line Circuit Breaker		**334793**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit 125 A	1	X-6306-100
Line Circuit Breaker		**334794**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-102
Line Circuit Breaker		**334795**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-103

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334796**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-111
Line Circuit Breaker		**334797**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-112
Line Circuit Breaker		**334798**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-117
Line Circuit Breaker		**334799**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Cover, side	1	364497
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-118
Line Circuit Breaker		**334800**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-96

Description	Qty.	Part No.
Line Circuit Breaker		**334801**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-97
Line Circuit Breaker		**334802**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A	1	X-6306-99
Line Circuit Breaker		**334803**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit 125 A	1	X-6306-100
Line Circuit Breaker		**334804**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-102
Line Circuit Breaker		**334805**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-103
Line Circuit Breaker		**334806**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-111

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**334807**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-112
Line Circuit Breaker		**334808**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-117
Line Circuit Breaker		**334809**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Bus, line	3	364510
Screw, socket head cap	3	M912-08025-60
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-118
Line Circuit Breaker		**334810**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Bus, line	3	364511
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-120
Line Circuit Breaker		**334811**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Bus, line	3	364511
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-121

Description	Qty.	Part No.
Line Circuit Breaker		**334812**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Bus, line	3	364511
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-124
Line Circuit Breaker		**334813**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	364484
Bus, line	3	364511
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-125
Line Circuit Breaker		**335052**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM10527-SD
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 225 A, 600 V, 3-pole	1	X-6304-15
Line Circuit Breaker		**360486**
Breaker, circuit, 30 A, 600 V, 3-pole	1	269250
Cover, side	1	360440-BLK
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**360598**
Breaker, circuit, 40 A, 600 V, 3-pole	1	269252
Cover, side	1	360440-BLK
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**360755**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	GM10528-BLK
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 200 A, 600 V, 3-pole	1	X-6304-13

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**GM12342-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	360969
Cover, side	1	364496
Bus, line	3	364509
Insulation, CB	2	365627
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-116
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker		**GM12343-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-80
Line Circuit Breaker		**GM12344-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Cover, side	1	364494-BLK
Bus, line	3	364498
Nut, hex 5mm	4	M934-05-50
Washer, spring, .39 ID x .81 in. OD	4	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-84
Line Circuit Breaker, 225 A		**GM12345-KA1**
Bracket, circuit breaker	1	222999
Insulator	2	290020
Cover, side	1	GM12332-BLK
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Breaker, circuit, 225 A, 600 V, 3-pole	1	X-6304-16
Line Circuit Breaker, 225 A W/12 V S.T.		**GM12345-KA2**
Bracket, circuit breaker	1	222999
Insulator	2	290020
Cover, side	1	GM12332-BLK
Nut, hex 5mm	4	M934-05-50
Breaker, circuit, 225 A, 600 V, 3-pole	1	X-6304-15
Line Circuit Breaker, 225 A W/24 V S.T.		**GM12345-KA3**
Bracket, circuit breaker	1	222999
Insulator	2	290020
Cover, side	1	GM12332-BLK
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Breaker, circuit	1	X-6304-81
Line Circuit Breaker, 250 A		**GM12345-KA4**
Bracket, circuit breaker	1	222999
Insulator	2	290020
Cover, side	1	GM12332-BLK
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Breaker, circuit	1	X-6304-85

Description	Qty.	Part No.
Line Circuit Breaker, 250 A W/12 V S.T.		**GM12345-KA5**
Bracket, circuit breaker	1	222999
Insulator	2	290020
Cover, side	1	GM12332-BLK
Nut, hex 5mm	4	M934-05-50
Breaker, circuit	1	X-6304-86
Line Circuit Breaker, 250 A W/24 V S.T.		**GM12345-KA6**
Bracket, circuit breaker	1	222999
Insulator	2	290020
Cover, side	1	GM12332-BLK
Nut, hex 5mm	4	M934-05-50
Breaker, circuit	1	X-6304-87
Line Circuit Breaker, 300 A		**GM12379-KA1**
Bracket, circuit breaker	1	222999
Insulator	2	290020
Cover, side	1	GM12333-BLK
Bus, line	3	GM12335
Decal, power breaker	1	GM15301
Washer, plain, .406 ID x 1 in. OD	9	X-25-118
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-88
Screw, slotted pan head machine	4	X-6308-1
Nut, hex, 3/8-16, zinc	3	X-83-7
Line Circuit Breaker, 350 A		**GM12379-KA2**
Bracket, circuit breaker	1	222999
Insulator	2	290020
Cover, side	1	GM12333-BLK
Bus, line	3	GM12335
Decal, power breaker	1	GM15301
Washer, plain, .406 ID x 1 in. OD	9	X-25-118
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-92
Screw, slotted pan head machine	4	X-6308-1
Nut, hex, 3/8-16, zinc	3	X-83-7
Line Circuit Breaker, 400 A		**GM12379-KA3**
Bracket, circuit breaker	1	222999
Insulator	2	290020
Cover, side	1	GM12333-BLK
Bus, line	3	GM12335
Decal, power breaker	1	GM15301
Washer, plain, .406 ID x 1 in. OD	9	X-25-118
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Breaker, circuit	1	X-6304-96
Screw, slotted pan head machine	4	X-6308-1
Nut, hex, 3/8-16, zinc	3	X-83-7
Line Circuit Breaker, 450 A		**GM12380-KA1**
Bracket, circuit breaker	1	222999
Insulation, CB	2	365627
Cover, side	1	GM12334-BLK
Bus, line	3	GM12336
Washer, plain, .406 ID x 1 in. OD	6	X-25-118
Washer, spring, .46 ID x .875 in. OD	6	X-6086-20
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6304-100
Nut, hex, 3/8-16, zinc	3	X-83-7
Line Circuit Breaker, 500 A		**GM12380-KA2**
Bracket, circuit breaker	1	222999
Insulation, CB	2	365627
Cover, side	1	GM12334-BLK
Bus, line	3	GM12336
Decal, power breaker	1	GM15301
Washer, plain, .406 ID x 1 in. OD	6	X-25-118
Washer, spring, .46 ID x .875 in. OD	6	X-6086-20
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6304-103
Nut, hex, 3/8-16, zinc	3	X-83-7

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker, 600A		**GM12380-KA3**
Bracket, circuit breaker	1	222999
Insulation, CB	2	365627
Cover, side	1	GM12334-BLK
Bus, line	3	GM12336
Decal, power breaker	1	GM15301
Washer, plain, .406 ID x 1 in. OD	6	X-25-118
Washer, spring, .46 ID x .875 in. OD	6	X-6086-20
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6304-108
Nut, hex, 3/8-16, zinc	3	X-83-7
Line Circuit Breaker, 700 A		**GM12380-KA4**
Bracket, circuit breaker	1	222999
Insulation, CB	2	365627
Cover, side	1	GM12334-BLK
Bus, line	3	GM12336
Decal, power breaker	1	GM15301
Washer, plain, .406 ID x 1 in. OD	6	X-25-118
Washer, spring, .46 ID x .875 in. OD	6	X-6086-20
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6304-111
Nut, hex, 3/8-16, zinc	3	X-83-7
Line Circuit Breaker, 800 A		**GM12380-KA5**
Bracket, circuit breaker	1	222999
Insulation, CB	2	365627
Cover, side	1	GM12334-BLK
Bus, line	3	GM12336
Decal, power breaker	1	GM15301
Washer, plain, .406 ID x 1 in. OD	6	X-25-118
Washer, spring, .46 ID x .875 in. OD	6	X-6086-20
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6304-116
Nut, hex, 3/8-16, zinc	3	X-83-7
Line Circuit Breaker, 225-250 A		**GM12536-KA1**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Bus, line	3	GM10411
Bus, line	3	GM10412
Cover, side	1	GM12539-BLK
Screw, socket head cap	3	M912-08025-60
Washer, plain, .406 ID x 1 in. OD	6	X-25-118
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-117
Nut, hex, 3/8-16, zinc	3	X-83-7
Line Circuit Breaker, 300-400 A		**GM12537-KA1**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Bus, line	3	GM10413
Bus, line	3	GM10414
Line circuit breaker base parts	1	GM12537-B
Cover, side	1	GM12540-BLK
Washer, plain, .406 ID x 1 in. OD	6	X-25-118
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-120
Nut, hex, 3/8-16, zinc	3	X-83-7

Description	Qty.	Part No.
Line Circuit Breaker, 450-630 A		**GM12537-KA2**
Insulator	2	290020
Tag, hang	1	336020
Bracket, circuit breaker	1	352323
Bus, line	3	GM10413
Bus, line	3	GM10414
Bus, line	3	GM10415
Line circuit breaker base parts	1	GM12537-B
Cover, side	1	GM12540-BLK
Washer, plain, .406 ID x 1 in. OD	6	X-25-118
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-124
Nut, hex, 3/8-16, zinc	3	X-83-7
Line Circuit Breaker, 700-800 A		**GM12538-KA1**
Bracket, circuit breaker	1	222998
Insulator	4	290020
Tag, hang	1	336020
Cover, side	1	GM12333-BLK
Bus, line	3	GM12336
Washer, plain, .406 ID x 1 in. OD	6	X-25-118
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit	1	X-6306-136
Nut, hex, 3/8-16, zinc	3	X-83-7
12 V Shunt Trip, 300-400 A UL		**GM12606-KA1**
Breaker, circuit	1	X-6304-138
24 V Shunt Trip, 300-400 A UL		**GM12606-KA2**
Breaker, circuit	1	X-6304-139
Auxiliary Switch, 300-400 A UL		**GM12606-KA3**
Breaker, circuit	1	X-6304-140
12 V Shunt Trip, 450-1200 A UL		**GM12607-KA1**
Breaker, circuit	1	X-6304-141
24 V Shunt Trip, 450-1200 A UL		**GM12607-KA2**
Breaker, circuit	1	X-6304-142
Auxiliary Switch, 450-1200 A UL		**GM12607-KA3**
Breaker, circuit	1	X-6304-143
12 V Shunt Trip, 80-630 A IEC		**GM12608-KA1**
Breaker, circuit	1	X-6306-143
24 V Shunt Trip, 80-630 A IEC		**GM12608-KA2**
Breaker, circuit	1	X-6306-144
Auxiliary/Alarm Switch, 80-630 A IEC		**GM12608-KA3**
Breaker, circuit	1	X-6306-145
12 V Shunt Trip, 700-1250 A IEC		**GM12609-KA1**
Breaker, circuit	1	X-6306-146
24 V Shunt Trip, 700-1250 A IEC		**GM12609-KA2**
Breaker, circuit	1	X-6306-147
Auxiliary/Alarm Switch, 700-1250 A IEC		**GM12609-KA3**
Breaker, circuit	1	X-6306-148
Line Circuit Breaker		**GM14027-KA1**
Breaker, circuit, 30 A, 600 V, 3-pole	1	269250
Cover, side	1	GM14296-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**GM14027-KA10**
Cover, side	1	GM14297-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Circuit breaker, 70 A, 600 V, 4 pole	1	X-6250-8
Line Circuit Breaker		**GM14027-KA11**
Breaker, circuit, 80 A, 480 V, 3-pole	1	253225
Cover, side	1	GM14296-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**GM14027-KA12**
Cover, side	1	GM14297-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 80 A, 480 V, 4-pole	1	X-6250-4
Line Circuit Breaker		**GM14027-KA13**
Breaker, circuit, 90 A, 480 V, 3-pole	1	344905
Cover, side	1	GM14296-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**GM14027-KA14**
Cover, side	1	GM14297-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit (with shunt trip)	1	X-6250-16
Line Circuit Breaker		**GM14027-KA15**
Breaker, circuit, 100 A, 480 V, 3-pole	1	253226
Cover, side	1	GM14296-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**GM14027-KA16**
Cover, side	1	GM14297-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 100 A, 480 V, 4-pole	1	X-6250-5
Line Circuit Breaker		**GM14027-KA2**
Cover, side	1	GM14297-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Circuit breaker, 30 A, 600 V, 4 pole	1	X-6250-1
Line Circuit Breaker		**GM14027-KA3**
Breaker, circuit, 40 A, 600 V, 3-pole	1	269252
Cover, side	1	GM14296-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**GM14027-KA4**
Cover, side	1	GM14297-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Circuit breaker, 40 A, 600 V, 4 pole	1	X-6250-2
Line Circuit Breaker		**GM14027-KA5**
Breaker, circuit, 50 A, 600 V, 3-pole	1	258928
Cover, side	1	GM14296-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**GM14027-KA6**
Cover, side	1	GM14297-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Circuit breaker, 50 A, 600 V, 4 pole	1	X-6250-6
Line Circuit Breaker		**GM14027-KA7**
Breaker, circuit, 60 A, 600 V, 3-pole	1	253224
Cover, side	1	GM14296-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker		**GM14027-KA8**
Cover, side	1	GM14297-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2
Circuit breaker, 60 A, 600 V, 4 pole	1	X-6250-3
Line Circuit Breaker		**GM14027-KA9**
Breaker, circuit, 70 A, 600 V, 3-pole	1	258381
Cover, side	1	GM14296-BLK
Decal, power breaker	1	GM15301
Screw, cross recess pan head machine	4	X-49-2

Description	Qty.	Part No.
Line Circuit Breaker		**GM14028-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 4mm	4	M934-04-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-51
Line Circuit Breaker		**GM14028-KA2**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 4mm	4	M934-04-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-52
Line Circuit Breaker		**GM14028-KA3**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 4mm	4	M934-04-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-54
Line Circuit Breaker		**GM14028-KA4**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 4mm	4	M934-04-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-55
Line Circuit Breaker		**GM14028-KA5**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 4mm	4	M934-04-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-57

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**GM14028-KA6**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 4mm	4	M934-04-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-58
Line Circuit Breaker		**GM14029-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-61
Line Circuit Breaker		**GM14029-KA10**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-79
Line Circuit Breaker		**GM14029-KA11**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-82
Line Circuit Breaker		**GM14029-KA12**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-83

Description	Qty.	Part No.
Line Circuit Breaker		**GM14029-KA2**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-62
Line Circuit Breaker		**GM14029-KA3**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-65
Line Circuit Breaker		**GM14029-KA4**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-66
Line Circuit Breaker		**GM14029-KA5**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-69
Line Circuit Breaker		**GM14029-KA6**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-70

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker		**GM14029-KA7**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-74
Line Circuit Breaker		**GM14029-KA8**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-75
Line Circuit Breaker		**GM14029-KA9**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	3	364498
Cover, side	1	GM14298-BLK
Bracket, circuit breaker	2	GM14300
Decal, power breaker	1	GM15301
Nut, hex 5mm	4	M934-05-50
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-78
Line Circuit Breaker		**GM14030-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Cover, side	1	GM14299-BLK
Bracket, circuit breaker	2	GM14300
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-93
Line Circuit Breaker		**GM14030-KA2**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Cover, side	1	GM14299-BLK
Bracket, circuit breaker	2	GM14300
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-96

Description	Qty.	Part No.
Line Circuit Breaker		**GM14030-KA3**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Cover, side	1	GM14299-BLK
Bracket, circuit breaker	2	GM14300
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A	1	X-6306-99
Line Circuit Breaker		**GM14030-KA4**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Cover, side	1	GM14299-BLK
Bracket, circuit breaker	2	GM14300
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-102
Line Circuit Breaker		**GM14030-KA5**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bus, line	3	364510
Bus, line	3	GM10167
Cover, side	1	GM14299-BLK
Bracket, circuit breaker	2	GM14300
Screw, socket head cap	3	M912-08025-60
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-111
Line Circuit Breaker		**GM14030-KA6**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324314
Tag, hang	1	336020
Tag, ground	1	354518
Bus, line	3	364510
Bus, line	3	GM10167
Cover, side	1	GM14299-BLK
Bracket, circuit breaker	2	GM14300
Screw, socket head cap	3	M912-08025-60
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-117
Line Circuit Breaker, 80 A		**GM17677-KA1**
Breaker, circuit, 80 A, 480 V, 3-pole	1	253225
Cover, side	1	GM17667-BLK
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker, 80 A W/12 V S.T.		**GM17677-KA2**
Decal, power breaker	1	GM15301
Cover, side	1	GM17668-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 80 A, 480 V, 4-pole	1	X-6250-4
Line Circuit Breaker, 90 A		**GM17677-KA3**
Breaker, circuit, 90 A, 480 V, 3-pole	1	344905
Decal, power breaker	1	GM15301
Cover, side	1	GM17667-BLK
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker, 90 A W/12 V S.T.		**GM17677-KA4**
Decal, power breaker	1	GM15301
Cover, side	1	GM17668-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit (with shunt trip)	1	X-6250-16

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker, 100 A		**GM17677-KA5**
Breaker, circuit, 100 A, 480 V, 3-pole	1	253226
Decal, power breaker	1	GM15301
Cover, side	1	GM17667-BLK
Screw, cross recess pan head machine	4	X-49-2
Line Circuit Breaker, 100 A W/12 V S.T.		**GM17677-KA6**
Decal, power breaker	1	GM15301
Cover, side	1	GM17668-BLK
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 100 A, 480 V, 4-pole	1	X-6250-5
Line Circuit Breaker, 90 A		**GM17678-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	6	X-25-75
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-54
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	3	X-82-6
Line Circuit Breaker, 90 A W/12 V S.T.		**GM17678-KA2**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	6	X-25-75
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-55
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	3	X-82-6
Line Circuit Breaker, 100 A		**GM17678-KA3**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	6	X-25-75
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-57
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	3	X-82-6

Description	Qty.	Part No.
Line Circuit Breaker, 100 A W/12 V S.T.		**GM17678-KA4**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	6	X-25-75
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-58
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	3	X-82-6
Line Circuit Breaker, 125 A		**GM17679-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-61
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 225 A W/12 V S.T.		**GM17679-KA10**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-79
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker, 250 A		**GM17679-KA11**
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-82
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 250 A W/12 V S.T.		**GM17679-KA12**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-83
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 125 A W/12 V S.T.		**GM17679-KA2**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-62
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6

Description	Qty.	Part No.
Line Circuit Breaker, 150 A		**GM17679-KA3**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-65
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 150 A W/12 V S.T.		**GM17679-KA4**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-66
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 175 A		**GM17679-KA5**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-69
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker, 175 A W/12 V S.T.		**GM17679-KA6**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-70
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 200 A		**GM17679-KA7**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-74
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 200 A W/12 V S.T.		**GM17679-KA8**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-75
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6

Description	Qty.	Part No.
Line Circuit Breaker, 225 A		**GM17679-KA9**
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364498
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17638-BLK
Nut, hex 5mm	4	M934-05-50
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-78
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 300 A		**GM17680-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364508
Decal, power breaker	1	GM15301
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17639-BLK
Washer, plain, .406 ID x 1 in. OD	3	X-25-118
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-88
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 350 A		**GM17680-KA2**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364508
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17639-BLK
Washer, plain, .406 ID x 1 in. OD	3	X-25-118
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-92
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker, 400 A		**GM17680-KA3**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	364508
Decal, power breaker	1	GM15301
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17639-BLK
Washer, plain, .406 ID x 1 in. OD	3	X-25-118
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-96
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 450 A		**GM17681-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	2	364509
Insulation, CB	2	365627
Decal, power breaker	1	GM15301
Bus, line	1	GM17633
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17636-BLK
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .46 ID x .875 in. OD	6	X-6086-20
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6304-100
Screw, pan head machined	4	X-6308-2
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 90-100 A		**GM17682-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17637-BLK
Washer, plain, .344 ID x .875 in. OD	6	X-25-75
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 90-100 A	1	X-6306-96
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	3	X-82-6

Description	Qty.	Part No.
Line Circuit Breaker, 125 A		**GM17682-KA2**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17637-BLK
Cover, side	1	GM17637-BLK
Washer, plain, .344 ID x .875 in. OD	6	X-25-75
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 125 A	1	X-6306-99
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	3	X-82-6
Line Circuit Breaker, 150 A		**GM17682-KA3**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17637-BLK
Washer, plain, .344 ID x .875 in. OD	6	X-25-75
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-102
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	3	X-82-6
Line Circuit Breaker, 175-200 A		**GM17682-KA4**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bus, line	3	364510
Bus, line	3	GM10167
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17637-BLK
Screw, socket head cap	3	M912-08025-60
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-111
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker, 225-250 A		**GM17682-KA5**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bus, line	3	364510
Bus, line	3	GM10167
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17637-BLK
Screw, socket head cap	3	M912-08025-60
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-117
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 300-400 A		**GM17683-KA1**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bus, line	3	364511
Bus, line	3	GM10168
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17635-BLK
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-120
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker, 450-630 A		**GM17683-KA2**
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Insulator	2	290020
Bus, load	1	324313
Tag, hang	1	336020
Tag, ground	1	354518
Bus, line	3	364511
Bus, line	3	GM10168
Bus, line	3	GM10169
Bracket, circuit breaker	2	GM17634
Cover, side	1	GM17635-BLK
Washer, plain, .344 ID x .875 in. OD	12	X-25-75
Washer, spring, .39 ID x .81 in. OD	6	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit	1	X-6306-124
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Nut, hex, 5/16-18	6	X-82-6
Line Circuit Breaker		**GM17879-KA1**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222998
Insulator	2	290020
Tag, hang	1	336020
Bus, line	3	365609
Decal, power breaker	1	GM15301
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit, 1200 A, 600 V, 3-pole	1	X-6305-134

Description	Qty.	Part No.
Line Circuit Breaker		**GM17880-KA1**
Cover, side	1	222996-BLK
Bracket, circuit breaker	1	222998
Insulator	2	290020
Tag, hang	1	336020
Bus, line	3	365609
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Breaker, circuit, 1200 A, 600 V, 3-pole	1	X-6305-135
Line Circuit Breaker, Dual 125 A/100 A		**GM19636-KA1**
Cover, side	1	222833
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	3	222910
Insulator	4	290020
Bus, load	1	324314
Tag, ground	1	354518
Bus, line	2	364498
Washer, plain, .203 ID x .75 in. OD	8	X-25-45
Spacer, .375 ID x .75 OD x .5 in.	4	X-400-104
Screw, slotted pan head machine	4	X-50-41
Screw, slotted round head machine	4	X-50-46
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit, 100 A	1	X-6304-159
Breaker, circuit 125 A	1	X-6304-160
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Line Circuit Breaker, Dual 200 A/150 A		**GM19641-KA1**
Cover, side	1	222833
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	4	290020
Bus, load	1	324314
Diagram, wiring	1	336917
Bus, line	2	364498
Washer, plain, .203 ID x .75 in. OD	8	X-25-45
Screw, slotted pan head machine	8	X-50-41
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit 200 A	1	X-6304-161
Breaker, circuit 150 A	1	X-6304-162
Line Circuit Breaker, Dual 225 A/175 A		**GM19641-KA2**
Cover, side	1	222833
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Insulator	4	290020
Bus, load	1	324314
Bus, line	3	364498
Washer, plain, .203 ID x .75 in. OD	8	X-25-45
Screw, slotted pan head machine	8	X-50-41
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit 225 A	1	X-6304-165
Breaker, circuit 175 A	1	X-6304-166

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker, Dual 350 A/250 A		**GM19642-KA1**
Cover, side	1	222833
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Spacer .281 x .500 x .375 steel	4	265861
Insulator	4	290020
Bus, load	1	324313
Bracket, circuit breaker	3	336632
Tag, ground	1	354518
Channel, insulating	1	GM13940
Washer, plain, .406 ID x 1 in. OD	2	X-25-118
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	1	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit 250 A	1	X-6304-163
Breaker, circuit	1	X-6304-95
Screw, slotted pan head machine	4	X-6308-1
Marker, wire	2	X-750-14
Marker, wire	2	X-750-15
Marker, wire	2	X-750-16
Nut, hex, 3/8-16, zinc	1	X-83-7
Line Circuit Breaker, Dual 350 A/250 A		**GM19645-KA1**
Cover, side	1	222835
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Spacer .281 x .500 x .375 steel	4	265861
Insulator	4	290020
Bus, load	1	324313
Bracket, circuit breaker	3	336632
Tag, ground	1	354518
Bus, line	3	360763
Channel, insulating	1	GM13940
Washer, plain, .406 ID x 1 in. OD	2	X-25-118
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Screw, slotted pan head machine	4	X-50-41
Washer, spring, .39 ID x .81 in. OD	1	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit 250 A	1	X-6304-163
Breaker, circuit	1	X-6304-95
Screw, slotted pan head machine	4	X-6308-1
Marker, wire	2	X-750-14
Marker, wire	2	X-750-15
Marker, wire	2	X-750-16
Nut, hex, 3/8-16, zinc	1	X-83-7
Line Circuit Breaker, Dual 450 A/350 A		**GM19646-KA1**
Cover, side	1	222835
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Relay, protective	1	227266
Transformer, curr., 400:5, round	3	248874
Insulator	6	290020
Bus, load	1	324313
Tag, ground	1	354518
Bus, line	3	365606
Plate	1	GM19468
Bracket, circuit breaker	3	GM19660
Spacer, .375 ID x .75 OD x .5 in.	4	X-400-104
Screw, slotted round head machine	4	X-51-53
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit 450 A	1	X-6304-167
Breaker, circuit 350 A	1	X-6304-168
Screw, pan head machine	8	X-6308-2

Description	Qty.	Part No.
Line Circuit Breaker, Dual 200 A/150 A		**GM19665-KA1**
Cover, side	1	222835
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Relay, protective	1	227266
Transformer, curr., 400:5, round	3	248874
Insulator	4	290020
Bus, load	1	324313
Tag, ground	1	354518
Plate	1	GM19468
Washer, plain, .203 ID x .75 in. OD	8	X-25-45
Washer, plain, .344 ID x .875 in. OD	8	X-25-75
Screw, slotted pan head machine	8	X-50-41
Washer, spring, .39 ID x .81 in. OD	3	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit 200 A	1	X-6304-161
Breaker, circuit 150 A	1	X-6304-162
Nut, hex, 5/16-18	4	X-82-6
Line Circuit Breaker, 600 A		**GM19674-KA1**
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Relay, protective	1	227266
Transformer, curr., 500:5, round	3	248875
Bus, load	1	324313
Cover, side	1	360970-BLK
Bus, line	3	365606
Insulation, CB	2	365627
Plate	1	GM19468
Washer, spring, .39 ID x .81 in. OD	13	X-6086-6
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit 600 A	1	X-6304-169
Screw, pan head machine	4	X-6308-2
Line Circuit Breaker, Dual 225 A/175 A		**GM19678-KA1**
Cover, side	1	222835
Bracket, circuit breaker	1	222908
Bracket, circuit breaker	1	222909
Bracket, circuit breaker	2	222910
Relay, protective	1	227266
Transformer, curr., 500:5, round	3	248875
Insulator	4	290020
Bus, load	1	324314
Plate	1	GM19468
Washer, plain, .203 ID x .75 in. OD	8	X-25-45
Screw, slotted pan head machine	8	X-50-41
Standoff insulator, 1/4-20 x 1.5 in.	2	X-6128-3
Breaker, circuit 225 A	1	X-6304-165
Breaker, circuit 175 A	1	X-6304-166
Line Circuit Breaker, Dual 800 A/600 A		**GM19767-KA1**
Relay, protective	1	227266
Transformer, curr., 800:5 round	3	248878
Bus, lead	1	324313
Bracket, circuit breaker	1	328353
Bus, line	3	365609
Insulation, CB	2	365627
Cover, side	1	GM11950-BLK
Plate	1	GM19468
Bracket, circuit breaker mounting	1	GM23472
Screw, slotted round head machine	4	X-51-53
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
Standoff, insulator, 1/4-20 x 1.5 in.	2	X-6138-3
Breaker, circuit	1	X-6304-118
Breaker, circuit 600 A	1	X-6304-170
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16

Kit Parts List

Description	Qty.	Part No.
Line Circuit Breaker, Dual 700 A/600 A		**GM19767-KA2**
Relay, protective	1	227266
Transformer, curr., 800:5 round	3	248878
Bus, load	1	324313
Bracket, circuit breaker	1	328353
Bus, line	3	365609
Insulation, CB	2	365627
Cover, side	1	GM11950-BLK
Screw, HC (special thread length)	6	GM16793
Plate	1	GM19468
Bracket, circuit breaker mounting	1	GM23472
Screw, slotted round head machine	4	X-51-53
Washer, spring, .46 ID x .875 in. OD	6	X-6086-20
Washer, spring, .39 ID x .81 in. OD	7	X-6086-6
	2	X-6138-3
Breaker, circuit	1	X-6304-114
Breaker, circuit 600 A	1	X-6304-170
Nut, hex, 7/16-14	6	X-70-13
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Line Circuit Breaker, Dual 350 A/300 A		**GM19771-KA1**
Relay, protective	1	227266
Transformer, curr., 800:5 round	3	248878
Insulator	4	290020
Bus, load	1	324313
Bracket, circuit breaker	1	328353
Bus, line	3	360763
Channel, insulating	1	GM13940
Plate	1	GM19468
Cover, side	1	GM19819
Bracket, circuit breaker mounting	1	GM23472
Screw, slotted round head machine	4	X-51-53
Washer, spring, .39 ID x .81 in. OD	10	X-6086-6
	2	X-6138-3
Breaker, circuit 300 A	1	X-6304-171
Breaker, circuit	1	X-6304-95
Screw, slotted pan head machine	8	X-6308-1
Marker, wire	1	X-750-14
Marker, wire	1	X-750-15
Marker, wire	1	X-750-16
Line Circuit Breaker, 1800 A		**GM19875-KA1**
Bag, air	1	224796
Relay, protective	1	227266
Transformer, curr., 2000:5, round	3	291548
Box, circuit breaker	1	361991
Support and bus	1	361993
Screw, slotted round head machine	4	X-51-53
Breaker, circuit 1800 A	1	X-6304-177
Line Circuit Breaker		**PA-279889**
Breaker, circuit, 3000 A, 600 V, 3-pole	1	282049
Line Circuit Breaker		**PA-347596**
Breaker, circuit, 3000 A, 600 V, 3-pole	1	347594
Line Circuit Breaker		**PA-347597**
Breaker, circuit, 4000 A, 600 V, 3-pole	1	347595
Line Circuit Breaker		**PA-347599**
Breaker, circuit, 4000 A, 600 V, 3-pole	1	347598

Breaker, Safeguard Circuit Kits

Safeguard Breaker		**255127**
Washer, lock, .146 ID x .285 in. OD	4	X-22-6
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 4 A, 240 V, 3-pole	1	X-796-1
Safeguard Breaker		**255128**
Washer, lock, .146 ID x .285 in. OD	4	X-22-6
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 3 A, 240 V, 3-pole	1	X-796-4
Safeguard Breaker		**255129**
Washer, lock, .146 ID x .285 in. OD	4	X-22-6
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 5 A, 240 V, 3-pole	1	X-796-6
Safeguard Breaker		**255130**
Washer, lock, .146 ID x .285 in. OD	4	X-22-6
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 4.5 A, 240 V, 3-pole	1	X-796-2
Safeguard Breaker		**255131**
Washer, lock, .146 ID x .285 in. OD	4	X-22-6
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 3.5 A, 240 V, 3-pole	1	X-796-3
Safeguard Breaker		**272745**
Washer, lock, .146 ID x .285 in. OD	4	X-22-6
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 3 A, 240 V, 3-pole	1	X-796-4
Safeguard Breaker		**272746**
Washer, lock, .146 ID x .285 in. OD	4	X-22-6
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 3.5 A, 240 V, 3-pole	1	X-796-3
Safeguard Breaker		**272747**
Washer, lock, .146 ID x .285 in. OD	4	X-22-6
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 4 A, 240 V, 3-pole	1	X-796-1
Safeguard Breaker		**272748**
Washer, lock, .146 ID x .285 in. OD	4	X-22-6
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 5 A, 240 V, 3-pole	1	X-796-6
Safeguard Breaker		**275595**
Washer, lock, .146 ID x .285 in. OD	4	X-22-6
Screw, cross recess pan head machine	4	X-49-2
Breaker, circuit, 4.5 A, 240 V, 3-pole	1	X-796-2
Safeguard Breaker		**PA-255139**
Transformer, curr., 150:5, round	3	246886
Crct brkr 20-150 kW FRII	1	TT-591
Washer, plain, .156 ID x .375 in. OD	4	X-25-9
Screw, cross recess pan head machine	4	X-49-2
Jumper, two-terminal	1	X-6076-2
Breaker, circuit, 4.5 A, 240 V, 3-pole	1	X-796-2

Bus Bar Kits

Bus Bar		**222966**
Bracket, upper support	2	222962
Bracket, support (LS)	1	275457
Bracket, support (RS)	1	275458
Bus	4	275459
Insulator, lug	1	275562
Tag, ground	1	354518
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Washer, plain, .193 ID x .5 in. OD	4	X-25-92

Kit Parts List

Description	Qty.	Part No.
Bus Bar		**222967**
Bracket, upper support	1	222963
Bracket, upper support	1	222964
Insulator, panel	16	233269
Bracket, support (LS)	1	275454
Bracket, support (RS)	1	275455
Bus	4	275456
Insulator, lug	1	275598
Tag, ground	1	354518
Washer, plain, .281 ID x .625 in. OD	32	X-25-68
Washer, plain, .193 ID x .5 in. OD	4	X-25-92
Bus Bar		**222968**
Bracket, upper support	3	222963
Bracket, support	2	222965
Insulator, panel	27	233269
Bracket, support	1	274432
Channel, insulating	4	274434
Bracket, support (RS)	1	274741
Bus	4	275453
Insulator, lug	1	275598
Tag, ground	1	354518
Washer, plain, .193 ID x .5 in. OD	4	X-25-92
Bus Bar		**222970**
Support, main bus	2	274659
Bracket, upper support	1	274660
Bracket, lower support	1	274661
Bracket, support	2	336008
Channel, insulating	2	336009
Insulator, lug	1	336010
Lead	1	336011
Tag, ground	1	354518
Bus assembly	4	A-336007
Washer, plain, .391 ID x .875 in. OD	18	X-25-18
Washer, plain, .193 ID x .5 in. OD	6	X-25-92
Screw, self threading	2	X-67-107
Screw, hex washer head, drill	5	X-794-2
Nut, hex, 3/8-16, zinc	9	X-83-7
Bus Bar, 20-60 kW Deutz		**GM10154-KA1**
Bracket, upper support	2	222962
Bracket, support (LS)	1	275457
Bracket, support (RS)	1	275458
Bus	4	275459
Tag, ground	1	354518
Insulator, lug	1	GM10218
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Washer, plain, .193 ID x .5 in. OD	4	X-25-92
Bus Bar, 60-100 kW (4S)		**GM10156-KA1**
Bracket, upper support	1	222963
Bracket, upper support	1	222964
Insulator, panel	16	233269
Bracket, support (LS)	1	275454
Bracket, support (RS)	1	275455
Bus	4	275456
Insulator, lug	1	275598
Tag, ground	1	354518
Washer, plain, .281 ID x .625 in. OD	32	X-25-68
Washer, plain, .266 ID x 1 in. OD	4	X-25-73
Washer, plain, .193 ID x .5 in. OD	4	X-25-92
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6

Description	Qty.	Part No.
Bus Bar, 115-150 kW		**GM10157-KA1**
Bracket, upper support	3	222963
Bracket, support	2	222965
Insulator, panel	24	233269
Bracket, support	1	274432
Channel, insulating	4	274434
Bracket, support (RS)	1	274741
Bus	4	275453
Insulator, lug	1	275598
Tag, ground	1	354518
Washer, lock, .262 ID x .743 in. OD	48	X-22-12
Washer, plain, .266 ID x 1 in. OD	4	X-25-73
Washer, plain, .193 ID x .5 in. OD	4	X-25-92
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Bus Bar		**GM12552-KA1**
Support, main bus	2	274659
Bracket, lower support	1	274661
Channel, insulating	2	336009
Insulator, lug	1	336010
Tag, ground	1	354518
Bus, 170 kW Deutz	4	GM12553
Nut, hex	28	M934-08-60
Washer, plain, .406 ID x 1 in. OD	18	X-25-118
Washer, plain, .193 ID x .5 in. OD	6	X-25-92
Washer, spring, .39 ID x .81 in. OD	33	X-6086-6
Screw, hex washer head, drill	5	X-794-2
Nut, hex, 3/8-16, zinc	9	X-83-7
Bus Bar		**GM14031-KA1**
Bracket, support (LS)	1	275457
Bracket, support (RS)	1	275458
Bus	4	275459
Tag, ground	1	354518
Bracket, bus bar	2	GM14301
Insulator, lug	1	GM14302
Washer, plain, .203 ID x .75 in. OD	4	X-25-45
Washer, plain, .193 ID x .5 in. OD	4	X-25-92
Rivet, pop, .187 in.	8	X-781-11
Bus Bar		**GM17814-KA1**
Tab, identification	1	201620-83
Tab, identification	1	201620-84
Tab, identification	1	201620-94
Tab, identification	1	201620-95
Insulator, panel	16	233269
Bracket, support (LS)	1	275454
Bracket, support (RS)	1	275455
Bus	4	275456
Tag, ground	1	354518
Bracket, support	2	GM17815
Insulator, lug	1	GM17816
Washer, plain, .281 ID x .625 in. OD	32	X-25-68
Washer, plain, .266 ID x 1 in. OD	4	X-25-73
Washer, plain, .344 ID x .875 in. OD	18	X-25-75
Washer, plain, .193 ID x .5 in. OD	4	X-25-92
Washer, spring, .39 ID x .81 in. OD	9	X-6086-6
Rivet, pop, .187 in.	4	X-781-10
Rivet, pop, .187 in.	4	X-781-11
Nut, hex, 5/16-18	9	X-82-6

Bus Lug Kits

Bus Lug		**274693**
Bracket, lug restrainer	4	275473
Lug, terminal, aluminum	4	X-6207-7

Kit Parts List

Description	Qty.	Part No.
Bus Lug		**274694**
Bracket, lug restrainer	4	275471
Bracket, lug restrainer	4	275561
Washer, plain, .391 ID x .875 in. OD	8	X-25-18
Lug, terminal, aluminum	4	X-6207-8
Bus Lug		**274695**
Bracket, lug restrainer	4	275474
Washer, plain, .391 ID x .875 in. OD	8	X-25-18
Lug, terminal, aluminum	4	X-6207-5
Bus Lug		**274696**
Bracket, lug restrainer	4	275469
Washer, plain, .391 ID x .875 in. OD	16	X-25-18
Lug, terminal, aluminum	8	X-6207-8
Bus Lug		**274697**
Bracket, lug restrainer	4	275470
Lug, terminal, aluminum	4	X-6207-9
Bus Lug		**274698**
Lug, terminal, aluminum	4	297981
Washer, plain, .391 ID x .875 in. OD	16	X-25-18
Bus Lug		**274699**
Lug, terminal, aluminum	4	297983
Washer, plain, .391 ID x .875 in. OD	16	X-25-18
Bus Lug		**274700**
Lug, terminal, aluminum	4	297582
Washer, plain, .391 ID x .875 in. OD	16	X-25-18
Bus Lug		**274778**
Lug, terminal, aluminum	4	297981
Bus Lug		**274779**
Lug, terminal, aluminum	4	297983
Bus Lug, 3/0-08 (1 Wire/Term)		**GM10155-KA1**
Bracket, lug restrainer	4	275473
Lug, terminal, aluminum	4	X-6207-7
Bus Lug, 750mcm-3/0 (3 Wire/Term)		**GM10155-KA10**
Lug, terminal, aluminum	4	297983
Washer, plain, .406 ID x 1 in. OD	16	X-25-118
Washer, spring, .39 ID x .81 in. OD	8	X-6086-6
Nut, hex, 3/8-16, zinc	8	X-83-7
Bus Lug, 600mcm-02 (4 Wire/Term)		**GM10155-KA11**
Lug, terminal, aluminum	4	297582
Washer, plain, .406 ID x 1 in. OD	16	X-25-118
Washer, spring, .39 ID x .81 in. OD	8	X-6086-6
Nut, hex, 3/8-16, zinc	8	X-83-7
Bus Lug, 350mcm-06 (1 Wire/Term)		**GM10155-KA2**
Bracket, lug restrainer	4	275471
Bracket, lug restrainer	4	275561
Washer, spring, .515 ID x 1.06 in. OD	4	X-6086-5
Lug, terminal, aluminum	4	X-6207-8
Bus Lug, 500mcm-04 (1 Wire/Term)		**GM10155-KA3**
Bracket, lug restrainer	4	275474
Washer, spring, .515 ID x 1.06 in. OD	4	X-6086-5
Lug, terminal, aluminum	4	X-6207-5
Bus Lug, 350mcm-06 (2 Wire/Term)		**GM10155-KA4**
Bracket, lug restrainer	4	275469
Washer, spring, .515 ID x 1.06 in. OD	8	X-6086-5
Lug, terminal, aluminum	8	X-6207-8
Bus Lug, 600mcm-04 (1 Wore/Term)		**GM10155-KA5**
Bracket, lug restrainer	4	275470
Washer, spring, .515 ID x 1.06 in. OD	4	X-6086-5
Lug, terminal, aluminum	4	X-6207-9
Bus Lug, 600mcm-02 (2 Wire/Term)		**GM10155-KA6**
Lug, terminal, aluminum	4	297981
Washer, spring, .515 ID x 1.06 in. OD	8	X-6086-5
Bus Lug, 750mcm-3/0 (3 Wire/Term)		**GM10155-KA7**
Lug, terminal, aluminum	4	297983
Washer, spring, .515 ID x 1.06 in. OD	8	X-6086-5

Description	Qty.	Part No.
Bus Lug, 350mcm-06 (2wire/Term)		**GM10155-KA8**
Bracket, lug restrainer	4	275469
Washer, plain, .406 ID x 1 in. OD	16	X-25-118
Washer, spring, .39 ID x .81 in. OD	8	X-6086-6
Lug, terminal, aluminum	8	X-6207-8
Nut, hex, 3/8-16, zinc	8	X-83-7
Bus Lug, 600mcm-02 (2wire/Term)		**GM10155-KA9**
Lug, terminal, aluminum	4	297981
Washer, plain, .406 ID x 1 in. OD	16	X-25-118
Washer, spring, .39 ID x .81 in. OD	8	X-6086-6
Nut, hex, 3/8-16, zinc	8	X-83-7

Bushing, Adapter for Silencer

Adapter Bushing		**PA-336807**
Bushing, reducer	1	X-202-35

Cable, Computer

PC Cable		**PA-294992**
Cable, multiconductor	1	294981
Connector	1	294988
Cable, DB9M\DB9F, null modem	1	GM16657
Controller communications kits	1	TT-847

Cables For Remote Controller Kit

Cable, 5 Ft. Remote Mounting		**GM17244-KP1**
Terminal, pin, male, 20-24 AWG	3	226245
Terminal, spade, male	4	238582
Terminal, fast-on, male	2	238898
Block, terminal	3	246114
Marker, strip	1	254822
Connector, cable	2	292800
Terminal, socket, female, 20-24 AWG	3	292879
Strip, terminal	1	292940
Strip, marker	3	354483
Box, remote cable mounting	1	GM17206
Cover, remote cable mounting	1	GM17207
Box assembly, 5ft. remote mounting	1	GM17234-1
Harness, wiring 5 ft. extension	1	GM17236
Nut, hex 4mm	10	M934-04-50
Nut, hex 5mm	2	M934-05-50
Washer, lock, .172 ID x .333 in. OD	10	X-22-7
Washer, lock, .20 ID x .373 in. OD	2	X-22-9
Grommet, round	1	X-284-31
Cable tie, nylon	4	X-468-3
Screw, Phillips hex crimptite	4	X-6216-1

Kit Parts List

Description	Qty.	Part No.
Cable, 15 Ft. Remote Mounting		**GM17244-KP2**
Terminal, pin, male, 20-24 AWG	3	226245
Terminal, spade, male	4	238582
Terminal, fast-on, male	2	238898
Block, terminal	3	246114
Marker, strip	1	254822
Connector, cable	2	292800
Terminal, socket, female, 20-24 AWG	3	292879
Strip, terminal	1	292940
Strip, marker	3	354483
Box, remote cable mounting	1	GM17206
Cover, remote cable mounting	1	GM17207
Box assembly, 15 ft. remote mounting	1	GM17234-2
Harness, wiring 15 ft. extension	1	GM17238
Nut, hex 4mm	10	M934-04-50
Nut, hex 5mm	2	M934-05-50
Washer, lock, .172 ID x .333 in. OD	10	X-22-7
Washer, lock, .20 ID x .373 in. OD	2	X-22-9
Grommet, round	1	X-284-31
Cable tie, nylon	4	X-468-3
Screw, Phillips hex crimptite	4	X-6216-1
Cable, 25 Ft. Remote Mounting		**GM17244-KP3**
Terminal, pin, male, 20-24 AWG	3	226245
Terminal, spade, male	4	238582
Terminal, fast-on, male	2	238898
Block, terminal	3	246114
Marker, strip	1	254822
Connector, cable	2	292800
Terminal, socket, female, 20-24 AWG	3	292879
Strip, terminal	1	292940
Strip, marker	3	354483
Box, remote cable mounting	1	GM17206
Cover, remote cable mounting	1	GM17207
Box assembly, 25 ft. remote mounting	1	GM17234-3
Harness, wiring 25 ft. extension	1	GM17240
Nut, hex 4mm	10	M934-04-50
Nut, hex 5mm	2	M934-05-50
Washer, lock, .172 ID x .333 in. OD	10	X-22-7
Washer, lock, .20 ID x .373 in. OD	2	X-22-9
Grommet, round	1	X-284-31
Cable tie, nylon	4	X-468-3
Screw, Phillips hex crimptite	4	X-6216-1
Cable, 40 Ft. Remote Mounting		**GM17244-KP4**
Terminal, pin, male, 20-24 AWG	3	226245
Terminal, spade, male	4	238582
Terminal, fast-on, male	2	238898
Block, terminal	3	246114
Marker, strip	1	254822
Connector, cable	2	292800
Terminal, socket, female, 20-24 AWG	3	292879
Strip, terminal	1	292940
Strip, marker	3	354483
Box, remote cable mounting	1	GM17206
Cover, remote cable mounting	1	GM17207
Box assembly, 40 ft. remote mounting	1	GM17234-4
Harness, wiring 40 ft. extension	1	GM17242
Nut, Hex 4mm	10	M934-04-50
Nut, hex 5mm	2	M934-05-50
Washer, lock, .172 ID x .333 in. OD	10	X-22-7
Washer, lock, .20 ID x .373 in. OD	2	X-22-9
Grommet, round	1	X-284-31
Cable tie, nylon	4	X-468-3
Screw, Phillips hex crimptite	4	X-6216-1

Description	Qty.	Part No.
5 Ft. Cables For Remote Mounting		**PA-344559**
Block, terminal	1	243845
Block, terminal	1	246115
Box, remote connection	1	258845
Marker, strip	1	258848
Strip, marker	1	282824
Connector, cable	2	292800
Connector, 24-position	1	295145
Connector, jack, 24-position	1	295262
Harness, wiring, control panel	1	344557
Box, remote connection	1	A-344558
Remote connection, 20-2000 kW	1	TT-1064
Grommet, 2 1/8 x 2 1/2	1	X-284-10
Screw, cross recess round machine	2	X-51-11
Screw, cross recess pan head machine	1	X-51-15
Screw, slotted round head machine	2	X-51-53

Cap, Mushroom

Cap, Mushroom		**PA-224998**
Cap, vent	1	224685

Charging, Prime Power

Prime Power Charging		**336674**
Packing, thermal compound	1	287945
Boot	1	290262
Diode, 90 A	1	336677
Harness, wiring, 80-180 kW John Deere	1	336678
Bracket, diode mounting	1	336679
Screw, slotted pan head machine	2	X-50-6
Nut, hex machine screw, 10-32	2	X-70-3
Prime Power Charging		**336690**
Packing, thermal compound	1	287945
Boot	1	290262
Diode, 90 A	1	336677
Bracket, diode mounting	1	336679
Harness, wiring, 20-60 kW John Deere	1	336691
Screw, slotted pan head machine	2	X-50-6
Nut, hex machine screw, 10-32	2	X-70-3
Prime Power Charging		**360372**
Packing, thermal compound	3	287945
Wiring harness, 80-180 kW John Deere	1	336678
Bracket, diode mounting	3	336679
Washer, plain, .219 ID x .5 in. OD	6	X-25-36
Screw, slotted pan head machine	6	X-50-6
Nut, hex machine screw, 10-32	6	X-70-3
Prime Power Charging		**360373**
Packing, thermal compound	3	287945
Bracket, diode mounting	3	336679
Wiring harness, 20-60 kW John Deere	1	336691
Washer, plain, .219 ID x .5 in. OD	6	X-25-36
Screw, slotted pan head machine	6	X-50-6
Nut, hex machine screw, 10-32	6	X-70-3

Communications Kits

RS-232 Communication		**354197**
Cable, multiconductor, ribbon	1	352291
PCB assembly, I/O-RS232, Dec 340	1	A-352171
Controller communications kits	1	TT-847
Washer, lock, .172 ID x .333 in. OD	10	X-22-7
Spacer, .25 OD, .937 in.	4	X-712-14

Description	Qty.	Part No.
RS-485 Communication		**354198**
Cable, multiconductor, ribbon	1	352291
PCB assembly, I/O-RS485	1	A-352173
Controller communications kits	1	TT-847
Washer, lock, .172 ID x .333 in. OD	10	X-22-7
Spacer, .25 OD, .937 in.	4	X-712-14
Nut, hex machine screw, 8-32	4	X-72-4

Connection Kit, Terminal

Controller Connection		**347428**
Diagram, interconnection	1	328912
Strip, terminal	1	328913
Strip, marker	1	328914
Harness, wiring, engine	1	328915
Diagram, interconnection	1	354246
Screw, cross recess round machine	4	X-51-11
Conduit, convoluted	1	X-6003-69
Controller Connection Kit		**GM17032-KA1**
Customer connection assembly	1	GM13984
Diagram, accessory interconnection	1	GM16088
Harness, wiring controller connection	1	GM17033
Screw, cross recess round head machine	6	X-51-3
Spacer, .25 OD, .5 in.	6	X-712-9

Connector Kits, Flexible Exhaust

Flexible Exhaust Connector		**GM19877-KP1**
Adapter, flexible exhaust	1	GM19876
Clamp, exhaust	1	GM22535
Screw, hex cap	1	M931-08035-60
Nut, hex elastic stop	1	M982-08-80
Flexible Exhaust Connector		**GM22425-KP1**
Clamp, exhaust, 4.81 in.	1	276949
Adpater, flexible exhaust	1	GM22426
Flexible Exhaust Connector		**GM22876-KP1**
Adapter, flexible exhaust	1	276946
Clamp, exhaust	1	GM22535
Screw, hex cap	1	M931-08035-60
Nut, hex elastic stop	1	M982-08-80
Flexible Exhaust Connector		**PA-276943**
Adapter, flexible exhaust	1	276946
Adapter, flexible exhaust	1	276946
Clamp, exhaust, 3.15 in.	1	276948
Clamp, exhaust, 3.15 in.	1	276948
Pipe, 3 NPT	1	X-533-1
Hose, flexible exhaust	1	X-797-33
Flexible Exhaust Connector		**PA-276944**
Adapter, flexible exhaust	1	276947
Clamp, exhaust, 4.81 in.	1	276949
Flexible Exhaust Connector		**PA-276945**
Clamp, exhaust, 4.81 in.	1	276949
Adapter, flexible	1	276951
Pipe, 4 NPT	1	X-549-3
Hose, flexible	1	X-797-35
Flexible Exhaust Connector		**PA-324932**
Adapter, flex. exhaust	1	324932
Flexible Exhaust Connector		**PA-336809**
Clamp, exhaust, 4.81 in.	1	276949
Adapter, flexible exhaust	1	336801
Pipe, 5 NPT	1	X-707-1
Hose, flexible exhaust	1	X-797-40

Description	Qty.	Part No.
Flexible Exhaust		**PA-364307**
Gasket, exhaust	1	364326
Adapter, flex exhaust	1	364332
Bushing, reducing, 2 x 3 in. NPT	1	X-202-21
Flexible Exhaust		**PA-364308**
Adapter, flex exhaust	1	364333
Gasket, exhaust	1	364383
Bushing, reducing, 2 x 3 in. NPT	1	X-202-21
Flexible Exhaust Connector 3 in. NPT		**PA-364417**
Gasket, exhaust	1	364383
Adapter, flexible exhaust	1	364421
Flexible Exhaust Connector 4 in. NPT		**PA-364418**
Gasket, exhaust	1	364155
Adapter, flexible exhaust	1	364422
Flexible Exhaust Connector 5 in. NPT		**PA-364420**
Gasket, exhaust	1	364384
Adapter, flexible exhaust	1	364424

Contact Kit, Dry

Dry Contact 1 SPDT		**273912**
Grommet, round	1	243319
Box, dry contact	1	273942
Cover, dry contact	1	273943
Harness, wiring, switchgear	1	273944
Vibromount	4	282829
Diagram, interconnection	1	328912
Diagram, interconnection	1	354246
Contact	1	A-273945
PCB assembly, 1-relay dry contact	1	C-294301
Screw, Phillips hex crimptite	4	X-6216-1
Nut, hex machine screw, 8-32	4	X-70-12
Spacer, .25 OD, .5 in.	4	X-712-9
Dry Contact, 1 SPDT, 10 A		**GM17068-KP1**
Grommet, round	1	243319
Box, dry contact	1	273942
Cover, dry contact	1	273943
Wiring harness, switchgear	1	273944
Vibromount	4	282829
Contact	1	A-273945
PCB assembly, 1-relay dry contact	1	C-294301
Customer connection assembly	1	GM13984
Harness, wiring controller connection	1	GM17033
Single relay dry contact, 20-2000 kW	1	TT-1304
Bolt, hex cap	2	X-125-3
Screw, cross recess round head machine	6	X-51-3
Nut, flange whiz, 8-32	14	X-6210-4
Nut, flange spiralick, 5/16-18	2	X-6210-7
Screw, Phillips hex crimptite	4	X-6216-1
Nut, hex machine screw, 8-32	4	X-70-12
Spacer, .25 OD, .5 in.	6	X-712-9

Kit Parts List

Description	Qty.	Part No.
Contact Kit, Dry 10-Relay		
Dry Contact, 10 SPDT		**273913**
Grommet, round	1	243319
Cover, dry contact	1	273934
Harness, wiring, FRII rem. volt. reg.	1	273935
Vibromount	6	282829
Diagram, interconnection	1	328912
Box, dry contact	1	336394
Diagram, interconnection	1	354246
Contact, 10 circuit dry	1	A-273936
Washer, lock, .172 ID x .595 in. OD	6	X-22-18
Spacer, .282 ID x .5 OD x .531 in.	4	X-400-28
Screw, Phillips hex crimptite	4	X-6216-1
Nut, hex machine screw, 8-32	6	X-70-12
Dry Contact, 10 SPDT, 10 A		**GM17069-KP1**
Grommet, round	1	243319
Cover, dry contact	1	273934
Harness, wiring, FRII rem. volt. reg.	1	273935
Vibromount	6	282829
Box, dry contact	1	336394
Contact, 10 circuit dry	1	A-273936
PCB assembly, 10-relay dry contact	1	D-294303
Customer connection assembly	1	GM13984
Diagram, accessory interconnection	1	GM16088
Harness, wiring controller connection	1	GM17033
Ten-relay dry contact, 6-2000 kW	1	TT-723
Washer, lock, .172 ID x .595 in. OD	6	X-22-18
Spacer, .282 ID x .5 OD x .531 in.	4	X-400-28
Bolt, hex cap	4	X-465-7
Screw, cross recess round head machine	6	X-51-3
Nut, flange spiralock, 1/4-20	4	X-6210-2
Nut, flange whiz, 8-32	6	X-6210-4
Screw, Phillips hex crimptite	4	X-6216-1
Nut, hex machine screw, 8-32	6	X-70-12
Spacer, .25 OD, .5 in.	6	X-712-9
Control Module, Day Tank		
Day Tank Electronic		**224809**
Sensor, float	1	224814
Module, power	1	224825
Harness, wiring, extension	1	224881
Harness, wiring, 6-15 kW, 1-phase	1	224884
Switch, float, 1-pole	1	255600
Connector, jack, 9-position	1	299186
Connector, plug, 9-position	1	299187
Pump, motor assembly	1	A-290024
Grommet	1	X-284-35
Fitting, hose connector, 90 deg.	2	X-391-13
Hose	1	X-422-30
Clamp, 1 in. hose	2	X-426-10
Day Tank Electronic		**224810**
Sensor, float	1	224815
Module, power	1	224825
Harness, wiring, extension	1	224881
Harness, wiring, 6-15 kW, 1-phase	1	224884
Switch, float, 1-pole	1	255600
Connector, jack, 9-position	1	299186
Connector, plug, 9-position	1	299187
Pump, motor assembly	1	A-290024
Grommet	1	X-284-35
Fitting, hose connector, 90 deg.	2	X-391-13
Hose	1	X-422-30
Clamp, 1 in. hose	2	X-426-10

Description	Qty.	Part No.
Day Tank Electronic		**224813**
Sensor, float	1	224816
Module, power	1	224825
Harness, wiring, extension	1	224881
Harness, wiring, 6-15 kW, 1-phase	1	224884
Switch, float, 1-pole	1	255600
Connector, jack, 9-position	1	299186
Connector, plug, 9-position	1	299187
Pump, motor assembly	1	A-290024
Grommet	1	X-284-35
Fitting, hose connector, 90 deg.	2	X-391-13
Hose	1	X-422-30
Clamp, 1 in. hose	2	X-426-10
Day Tank Relay Control		**224850**
Coupling, conduit-elbow	1	156327
Coupling, conduit-elbow	1	156327
Harness, wiring, day tank, 6-60 kW	1	224873
Fuse, 5 A, 250 V	1	239298
Relay, 120 VAC, 15 A	1	241950
Cover, conduit box	1	266469
Fuse holder, inline	1	269216
Box, junction	1	274883
Harness, wiring, engine, 125-180 kW	1	275559
Switch, float	1	279746
Bracket, relay	1	279875
Box, controller	1	A-224874
Pump, motor assembly	1	A-290024
Washer, lock, .146 ID x .53 in. OD	1	X-22-25
Washer, lock, .172 ID x .333 in. OD	2	X-22-7
Fitting, hose connector, 90 deg.	2	X-391-13
Hose	1	X-422-31
Clamp, 1 in. hose	2	X-426-10
Screw, slotted pan head machine	2	X-50-3
Screw, slotted pan head machine	2	X-51-12
Coupling, non-metallic	1	X-567-1
Conduit, convoluted	1	X-6003-10
Nut, hex machine screw, 6-32	1	X-71-2
Day Tank Relay Control		**224851**
Coupling, conduit-elbow	1	156327
Coupling, conduit-elbow	1	156327
Harness, wiring, day tank, 6-60 kW	1	224873
Fuse, 5 A, 250 V	1	239298
Relay, 120 VAC, 15 A	1	241950
Cover, conduit box	1	266469
Fuse holder, inline	1	269216
Box, junction	1	274883
Harness, wiring, engine, 125-180 kW	1	275559
Switch, float	1	279746
Bracket, relay	1	279875
Box, controller	1	A-224874
Pump, motor assembly	1	A-290024
Washer, lock, .146 ID x .53 in. OD	1	X-22-25
Washer, lock, .172 ID x .333 in. OD	2	X-22-7
Fitting, hose connector, 90 deg.	2	X-391-13
Hose	1	X-422-30
Clamp, 1 in. hose	2	X-426-10
Screw, slotted pan head machine	2	X-50-3
Screw, slotted pan head machine	2	X-51-12
Coupling, non-metallic	1	X-567-1
Conduit, convoluted	1	X-6003-10
Nut, hex machine screw, 6-32	1	X-71-2

Kit Parts List

Description	Qty.	Part No.
Day Tank Electronic		**224852**
Coupling, conduit-elbow	1	156327
Coupling, conduit-elbow	1	156327
Switch, float	1	224869
Harness, wiring, day tank, 6-60 kW	1	224873
Fuse, 5 A, 250 V	1	239298
Relay, 120 VAC, 15 A	1	241950
Cover, conduit box	1	266469
Fuse holder, inline	1	269216
Box, junction	1	274883
Harness, wiring, engine, 125-180 kW	1	275559
Bracket, relay	1	279875
Box, controller	1	A-224874
Pump, motor assembly	1	A-290024
Washer, lock, .146 ID x .53 in. OD	1	X-22-25
Washer, lock, .172 ID x .333 in. OD	2	X-22-7
Fitting, hose connector, 90 deg.	2	X-391-13
Hose	1	X-422-30
Clamp, 1 in. hose	2	X-426-10
Screw, slotted pan head machine	2	X-50-3
Screw, slotted pan head machine	2	X-51-12
Coupling, non-metallic	1	X-567-1
Conduit, convoluted	1	X-6003-10
Nut, hex machine screw, 6-32	1	X-71-2
Day Tank Electronic		**224877**
Sensor, float	1	224814
Module, power	1	224825
Harness, wiring, day tank, 80-400 kW	1	224880
Harness, wiring, 6-15 kW, 1-phase	1	224884
Switch, float, 1-pole	1	255600
Connector, jack, 9-position	1	299186
Connector, plug, 9-position	1	299187
Pump, motor assembly	1	A-290024
Grommet	1	X-284-35
Fitting, hose connector, 90 deg.	2	X-391-13
Hose	1	X-422-31
Clamp, 1 in. hose	2	X-426-10
Day Tank Relay Control		**224878**
Coupling, conduit-elbow	1	156327
Coupling, conduit-elbow	1	156327
Fuse, 5 A, 250 V	1	239298
Relay, 120 VAC, 15 A	1	241950
Cover, conduit box	1	266469
Fuse holder, inline	1	269216
Box, junction	1	274883
Harness, wiring, motor	1	275558
Harness, wiring, engine, 125-180 kW	1	275559
Switch, float	1	279746
Bracket, relay	1	279875
Box, controller	1	A-274818
Pump, motor assembly	1	A-290024
Washer, lock, .146 ID x .53 in. OD	1	X-22-25
Washer, lock, .172 ID x .333 in. OD	2	X-22-7
Fitting, hose connector, 90 deg.	2	X-391-13
Hose	1	X-422-31
Clamp, 1 in. hose	2	X-426-10
Screw, slotted pan head machine	2	X-50-3
Screw, slotted pan head machine	2	X-51-12
Coupling, non-metallic	1	X-567-1
Conduit, convoluted	1	X-6003-10
Nut, hex machine screw, 6-32	1	X-71-2

Description	Qty.	Part No.
Day Tank Relay Control		**343678**
Coupling, conduit-elbow	1	156327
Coupling, conduit-elbow	1	156327
Switch, float	1	224869
Harness, wiring, day tank, 6-60 kW	1	224873
Fuse, 5 A, 250 V	1	239298
Relay, 120 VAC, 15 A	1	241950
Cover, conduit box	1	266469
Fuse holder, inline	1	269216
Box, junction	1	274883
Bracket, relay	1	279875
Harness, wiring, Sea Ray 4/6.5 kW marine	1	343676
Pump, motor assembly	1	A-290024
Box assembly, controller	1	A-343677
Conduit, flexible	1	X-214-22
Washer, lock, .146 ID x .53 in. OD	1	X-22-25
Washer, lock, .172 ID x .333 in. OD	2	X-22-7
Fitting, hose connector, 90 deg.	2	X-391-13
Hose	1	X-422-30
Clamp, 1 in. hose	2	X-426-10
Screw, slotted pan head machine	2	X-50-3
Screw, slotted pan head machine	2	X-51-12
Coupling, non-metallic	1	X-567-1
Conduit, convoluted	1	X-6003-10
Nut, hex machine screw, 6-32	1	X-71-2
In-Base Day Tank Relay Control		**GM10410-KA1**
Coupling, conduit-elbow	1	156327
Switch, float	1	279745
Pump, motor assembly	1	A-290024
Box assembly, controller	1	A-343677
Bracket, daytank controller mounting	1	GM10440
Nut, hex 5mm	2	M934-05-50
Fitting, hose connector, 90 deg.	2	X-391-13
Hose, flex fuel line	1	X-422-36
Clamp, hose, .5/1 in.	2	X-426-10
D.W. In-Base Daytank Elec Control		**GM10432-KA1**
Module, power	1	224825
Wiring harness, extension	1	224881
Wiring harness, 6-15 kw, 1-phase	1	224884
Switch, float, 1-pole	1	255600
Pump, motor assembly	1	A-290024
Sensor, float	1	GM10430
Fitting, hose connector, 90 deg.	2	X-391-13
Hose	1	X-422-30
Clamp, hose, .5/1 in.	2	X-426-10
Day Tank Relay Control Module		**GM17211-KA1**
Coupling, conduit-elbow	1	156327
Pump, motor assembly	1	A-290024
Box assembly, controller	1	A-343677
Switch, float	1	GM16906
Connector, 90 deg. (1/2 in. ID hose)	2	X-391-13
Hose	1	X-422-30
Clamp, hose, .5/1 in.	2	X-426-10
Screw, slotted pan head machine	2	X-50-3
Day Tank Relay Control Module		**GM17212-KA1**
Coupling, conduit-elbow	1	156327
Pump, motor assembly	1	A-290024
Box assembly, controller	1	A-343677
Switch, float	1	GM16907
Connector, 90 deg. (1/2 in. ID hose)	2	X-391-13
Hose	1	X-422-30
Clamp, hose, .5/1 in.	2	X-426-10
Screw, slotted pan head machine	2	X-50-3

Kit Parts List

Description	Qty.	Part No.
Day Tank Electronic Control Module		**GM22735-KA1**
Power module	1	224825
Wiring harness, extension	1	224881
Wiring harness, 1 phase	1	224884
Switch, float, 1 pole	1	255600
Pump, motor assembly	1	A-290024
Sensor, float	1	GM16909
Connector, 90 deg. (1/2 in. ID hose)	2	X-391-13
Hose	1	X-422-30
Clamp, hose, .5/1 in.	2	X-426-10
Day Tank Electronic Control Module		**GM22736-KA1**
Power module	1	224825
Wiring harness, extension	1	224881
Wiring harness, 1 phase	1	224884
Switch, float, 1 pole	1	255600
Pump, motor assembly	1	A-290024
Sensor, float	1	GM16910
Connector, 90 deg. (1/2 in. ID hose)	2	X-391-13
Hose	1	X-422-30
Clamp, hose, .5/1 in.	2	X-426-10

Converter Kits, Decision-Maker 340

Decision-Maker 340 Converter		**PA-352249**
Base, converter	1	320306
Cover, silkscreen	1	352520
PCB assembly, RS232/RS485 converter	1	B-352175
Converter assembly	1	B-352250
Controller communications kits	1	TT-847
Washer, lock, .172 ID x .333 in. OD	4	X-22-7
Nut, hex machine screw, 8-32	4	X-70-12
Spacer, .25 OD, .5 in.	4	X-712-9
Screw, slotted hex washer head mach.	4	X-794-3
Controller Retrofit		**PA-354267**
Lamp, 28 V, 4.8 W	2	283420
DEC340 literature	1	350162
Controller assembly, DEC340	1	A-347946

Cover, Radiator Cap Kits

Radiator Cap Cover		**258998**
Plug	1	253268
Hinge, panel	1	258994
Bracket	2	258996
Cover	1	258997
Lock, pad	1	289873

CSA For Reconnectible Generators Kits

CSA		**273741**
Decal, caution	1	239776
Decal, notice, neutral bonded	1	239789
Tag, instruction	1	255798
Decal	1	255882
Screw, hex head machine, special thread	4	273736
Guard, generator	1	274596
Decal, electrical equipment, 2.25 x 2.8	1	343292
Washer, lock, .391 ID x .681 in. OD	4	X-22-10
Conduit, convoluted	1	X-6003-17

Description	Qty.	Part No.
CSA		**273742**
Decal, caution	1	239776
Decal, notice, neutral bonded	1	239789
Tag, instruction	1	255798
Decal	1	255882
Guard, generator	1	274597
Decal, electrical equipment, 2.25 x 2.8	1	343292
Screw, hex head machine, special thread	4	352415
Washer, lock, .391 ID x .681 in. OD	4	X-22-10
Conduit, convoluted	1	X-6003-17
CSA		**347233**
Decal, caution	1	239776
Decal, notice, neutral bonded	1	239789
Tag, instruction	1	255798
Decal	1	255882
Screw, 1/2-13 x 4	4	273738
Decal, electrical equipment, 2.25 x 2.8	1	343292
Guard, generator CSA	1	347232
Washer, lock, .521 ID x .884 in. OD	4	X-22-4
Conduit, convoluted	1	X-6003-17
CSA With Rodent Guards		**347741**
Decal, caution	1	239776
Decal, notice, neutral bonded	1	239789
Tag, instruction	1	255798
Decal	1	255882
Screw, 1/2-13 x 4	4	273738
Decal, electrical equipment	1	343292
Guard, generator	1	347237
Screen, fan	2	347412
Washer, lock, .521 ID x .884 in. OD	4	X-22-4
Plug, button	1	X-301-24
Conduit, convoluted	1	X-6003-17
Conduit	1	X-6003-87
Screw, hex washer head, drill	2	X-794-2
CSA Approval, 4P		**GM19978-KA1**
Decal, caution	1	239776
Decal, notice	1	239789
Tag, instruction	1	255798
Decal, caution standby service connect	1	255882
Screw, hex head machine, special thread	4	273736
Guard, generator	1	274596
Decal, electrical equipment, 2.25 x 2.8	1	343292
Washer, lock, .391 ID x .681 in. OD	4	X-22-10
Plug, button	1	X-301-24
Conduit, convoluted	1	X-6003-17
Nut, flange spiralock, 3/8-16	4	X-6210-9
CSA Approval, 4S		**GM19978-KA2**
Decal, caution	1	239776
Decal, notice	1	239789
Tag, instruction	1	255798
Decal, caution standby service connect	1	255882
Guard, generator	1	274597
Decal, electrical equipment, 2.25 x 2.8	1	343292
Screw, hex head machine, special thread	4	352415
Washer, lock, .391 ID x .681 in. OD	4	X-22-10
Plug, button	1	X-301-24
Conduit, convoluted	1	X-6003-17
Nut, flange spiralock, 3/8-16	4	X-6210-9

Kit Parts List

Description	Qty.	Part No.
CSA Approval, 4UA		**GM19978-KA3**
Decal, caution	1	239776
Decal, notice	1	239789
Tag, instruction	1	255798
Decal, caution standby service connect	1	255882
Screw, hex head machine, special thread	4	273738
Decal, electrical equipment, 2.25 x 2.8	1	343292
Guard, generator CSA	1	347232
Washer, lock, .521 ID x .884 in. OD	4	X-22-4
Plug, button	1	X-301-24
Conduit, convoluted	1	X-6003-17
Nut, flange spiralock, 1/2-13	4	X-6210-12

Droop Compensator Kits, Reactive

Reactive Droop Compensator		**256496**
Transformer, curr., 300:5, round	1	233951
Nameplate, engraved, rheostat	1	283869
Rheostat (includes rheo. and knob)	1	X-467-4
Screw, slotted round head machine	3	X-51-5
Reactive Droop Compensator		**256497**
Transformer, curr., 400:5, round	1	233952
Nameplate, engraved, rheostat	1	283869
Rheostat (includes rheo. and knob)	1	X-467-4
Screw, slotted round head machine	3	X-51-5
Reactive Droop Compensator		**256498**
Transformer, curr., 600:5, round	1	233953
Nameplate, engraved, rheostat	1	283869
Rheostat (includes rheo. and knob)	1	X-467-4
Screw, slotted round head machine	3	X-51-5
Reactive Droop Compensator		**256499**
Transformer, curr., 1000:5, round	1	233954
Nameplate, engraved, rheostat	1	283869
Rheostat (includes rheo. and knob)	1	X-467-4
Screw, slotted round head machine	3	X-51-5
Reactive Droop Compensator		**256500**
Transformer, curr., 1600:5, round	1	233957
Nameplate, engraved, rheostat	1	283869
Rheostat (includes rheo. and knob)	1	X-467-4
Screw, slotted round head machine	3	X-51-5
Reactive Droop Compensator		**256505**
Transformer, curr., 2500:5, round	1	233955
Nameplate, engraved, rheostat	1	283869
Rheostat (includes rheo. and knob)	1	X-467-4
Screw, slotted round head machine	3	X-51-5

Emergency Stop Switch Kit, Local

Emergency Stop Button		**273845**
Switch, emergency stop pushbutton	1	292364
Decal, emergency stop	1	292467

Emergency Stop Switch Kit, Remote

Remote Emergency Stop Switch		**PA-293906**
Rod, glass	1	222655
Switch, emergency stop	1	A-222654
Remote emergency stop, 6-1600 kW	1	TT-940

Description	Qty.	Part No.

End Cap Kits, Skid

Skid End Caps		**275463**
End cap, skid	2	275460
Skid End Caps		**275464**
End cap, skid	2	GM19839
Skid End Caps		**324923**
End cap, skid (front)	1	324889
End cap, skid (rear)	1	324891
Skid End Caps		**336217**
End cap, skid, 44.58 in.	2	336216
Skid End Caps		**352644**
End cap, skid, 30.58 in.	2	352589
Skid End Caps, 4S7		**352645**
End cap, skid, 30.58 in.	2	352643
Skid End Caps W/Cable Entry		**364413**
Endcap, skid	1	364512
Skid End Cap W/Cable Entry		**364414**
Endcap, skid	1	364513
Skid End Caps W/Cable Entry		**GM10232-KA1**
End cap, skid	1	GM10233
Skid End Caps W/Cable Entry		**GM11922-KA1**
End Cap, Skid w/Cable Entry	1	GM10650
Skid End Cap		**GM15456-KA1**
Enclosure, skid	2	GM15453
Skid End Cap		**GM16287-KA1**
Enclosure, skid	2	GM15373
Skid End Cap		**GM16288-KA1**
Enclosure, skid	2	GM15375
Skid End Caps		**GM21057-KA1**
End cap, skid	2	GM17759-KCB
Skid End Caps		**GM21057-KA2**
End cap, skid	2	364050-KCB
Skid End Caps		**GM21057-KA3**
End cap, skid	2	364239-KCB
Skid End Caps		**GM21057-KA4**
Enclosure, skid	2	GM20810-KCB

FASTCHECK and Wire Harness Kit

FASTCHECK And Harness		**PA-272766**
Cover	1	254409
Decal, FASTCHECK, 3 x 4 in.	1	255405
Wiring harness, for FRII relay circuit	1	255915
Nut, dress cap, 1/4-40	1	269174
Clip, alligator	2	269952
Insulator, rotor	1	269953
Insulator, rotor	1	269954
Connector	1	287850
Hood, strain relief	2	287851
Box	1	287869
Nut, dress, 1/4-40	4	287873
Cap	1	287874
Connector, cable	1	292800
Connector, 24-position	1	295145
PCB assembly, test fast check	1	B-287848
Control assembly	1	B-291930

Kit Parts List

Description	Qty.	Part No.
Fill Cap Kit, 2-inch Locking		
2 in. Locking Fill Cap		**224684**
Cap, sealed fill	1	224683
Pipe (2 in. NPT x 2.00 in.)	1	X-219-9
Flange Kits, Weld-on		
Weld-On Flange 6 in.		**PA-343613**
Flange, weld-on	2	343609
Gasket, exhaust ring 6 in.	2	343611
Washer, plain, .812 ID x 1.469 in. OD	32	X-25-29
Screw, hex head machine	16	X-6239-4
Nut, hex, 3/4-10, zinc	16	X-88-12
Fuel Filters		
Fuel/Water Separator		**GM10958-KA1**
Fuel line, flexible	1	343603
Filter, assembly fuel/water separator	1	GM10571
Fitting, elbow, 5/8-18 x 1/4 in.	1	X-447-1
Fitting, elbow, 5/8-18 x 3/8 in.	1	X-447-9
Fuel Line Kits, Flexible		
Flexible Fuel Lines		**273618**
Fuel line, flexible	1	273614
Fuel line, flexible	1	273615
Fuel line	1	273616
Cap, 1/4 NPT pipe	2	X-268-3
Fitting, elbow, 7/16-20 x 1/8 in.	1	X-447-10
Fitting, elbow, oil line	2	X-447-7
Fitting, union	1	X-695-2
Flexible Fuel Lines		**324925**
Fuel line, flexible	1	324481
Fuel Line, flexible	1	324967
Cap, pipe	2	X-268-8
Fitting, half union	1	X-296-10
Fitting, half union	1	X-296-13
Fitting, half union	1	X-296-2
Elbow, oil line connection	1	X-447-21
Flexible Fuel Lines		**336864**
Line, .25 OD steel fuel	1	273631
Bracket, mounting	1	273643
Fuel line, flexible	1	336863
Fuel line, flexible	1	344205
Cap, 1/4 NPT pipe	1	X-268-3
Cap, pipe	1	X-268-8
Connector, half-union	1	X-296-11
Fitting, elbow, 7/8-14	1	X-447-8
Clamp, insulated, .5 in.	1	X-672-10
Fitting, union	1	X-695-2
Flexible Fuel Lines		**336866**
Line, .25 OD steel fuel	1	273631
Bracket, mounting	1	273916
Fuel line, flexible	1	336863
Fuel line, flexible	1	344205
Cap, 1/4 NPT pipe	1	X-268-3
Cap, pipe	1	X-268-8
Connector, half-union	1	X-296-11
Fitting, elbow, 7/8-14	1	X-447-8
Clamp, insulated, .5 in.	1	X-672-10
Fitting, union	1	X-695-2

Description	Qty.	Part No.
Flexible Fuel Lines		**352371**
Line, flexible fuel 37 inch	1	273629
Line, .25 OD steel fuel	1	273631
Fuel line, flexible	1	344210
Cap, 1/4 NPT pipe	2	X-268-3
Clamp, hose, .38/.88 in.	1	X-426-18
Fitting, elbow, oil line	2	X-447-7
Fitting, union	1	X-695-2
Flexible Fuel Lines		**352489**
Line, flexible fuel 37 inch	2	273629
Line, .25 OD steel fuel	1	273631
Cap, 1/4 NPT pipe	2	X-268-3
Fitting, elbow, 7/16-20 x 1/8 in.	1	X-447-10
Fitting, elbow, oil line	2	X-447-7
Fitting, union	1	X-695-2
Flexible Fuel Lines		**364134**
Cap, 1/4 NPT pipe	2	X-268-3
Fuel line, flexible	1	X-386-36
Fuel line, flexible	1	X-386-81
Fitting, hose connector 90deg.	1	X-391-20
Fitting, hose connector 90deg.	1	X-391-25
Clamp, hose, .25/.70 in.	4	X-426-9
Flexible Fuel Lines		**364314**
Washer, plain	1	M125A-08-80
Screw, hex cap	1	M933-08016-60
Cap, pipe	1	X-268-8
Cap, pipe, 3/8 NPT	1	X-268-9
Fuel line, flexible	1	X-386-112
Fitting, hose connector, 90 deg.	1	X-391-13
Fitting, hose connector 90deg.	1	X-391-30
Fuel line, flexible	1	X-422-21
Clamp, hose, .56/1.06 in.	4	X-426-3
Clamp, insulated, .75 in.	1	X-672-31
Fuel Lines For Fuel/Water Separator		**GM10959-KA1**
Fuel line, flexible	1	324481
Fuel line, flexible	1	324967
Cap, pipe	2	X-268-8
Fitting, half union	1	X-296-10
Fitting, half union	1	X-296-13
Fitting, half union	1	X-296-2
Connector, 1/2 union	1	X-296-25
Flexible Fuel Lines		**GM19461-KA1**
Fuel line, flexible	1	273615
Fuel line	1	273616
Fuel line, flexible	1	GM21201
Cap, pipe (3/8 in. NPT)	2	X-268-9
Clamp, hose, .38/.88 in.	1	X-426-18
Elbow, oil line (90 deg.) + vibra seal	1	X-447-23
Elbow, oil line (90 deg.) + vibra seal	1	X-447-9
Fitting, straight union	1	X-695-2
Flexible Fuel Lines		**GM19461-KA2**
Fuel line	1	273631
Fuel line, flexible	1	324608
Fuel line, flexible	1	GM21201
Cap, pipe (3/8 in. NPT)	2	X-268-9
Clamp, hose, .38/.88 in.	1	X-426-18
Elbow, oil line (90 deg.) + vibra seal	1	X-447-23
Elbow, oil line (90 deg.) + vibra seal	1	X-447-9
Fitting, straight union	1	X-695-2

Kit Parts List

Description	Qty.	Part No.
Flexible Fuel Lines		**GM22835-KA1**
Fuel line, flexible	1	336863
Fuel line, flexible	1	GM22836
Bracket, mounting	1	GM22837
Washer, lock, .521 ID x .884 in. OD	1	X-22-4
Cap, pipe (3/8 in. NPT)	1	X-268-9
Cap, pipe (3/8 in. NPT)	1	X-268-9
Clamp, hose, .38/.88 in.	1	X-426-18
Elbow, oil line (90 deg.) + vibra seal	1	X-447-14
Elbow, oil line (90 deg.) + vibra seal	1	X-447-15
Clamp, insulated, .5 in.	1	X-672-10
Flexible Fuel Lines		**GM22835-KA2**
Fuel line, flexible	1	336863
Fuel line, flexible	1	GM22836
Bracket, mounting	1	GM22837
Washer, lock, .656 ID x 1.058 in. OD	1	X-22-43
Cap, pipe (1/2 in. NPT)	1	X-268-8
Cap, pipe (3/8 in. NPT)	1	X-268-9
Clamp, hose, .38/.88 in.	1	X-426-18
Elbow, oil line (90 deg.) + vibra seal	1	X-447-15
Elbow, oil line (90 deg.)	1	X-447-8
Clamp, insulated, .5 in.	1	X-672-10

Fuel Pump Kits, Auxiliary

Auxiliary Fuel Pump, 12 VDC		**PA-324405**
Pump, fuel	1	229051
Lead, wire	2	229056

Fuel Pump Kits, Subbase Transfer Tank

Transfer Pump 120 V 60 Hz		**224875**
Coupling, conduit-elbow	1	156327
Coupling, conduit-elbow	1	156327
Harness, wiring, day tank, 6-60 kW	1	224873
Fuse, 5 A, 250 V	1	239298
Relay, 120 VAC, 15 A	1	241950
Cover, conduit box	1	266469
Fuse holder, inline	1	269216
Box, junction	1	274883
Harness, wiring, engine, 125-180 kW	1	275559
Bracket, relay	1	279875
Box, controller	1	A-224874
Pump, motor assembly	1	A-290024
Bushing, reducing, 1/4 x 1/2 in. NPT	1	X-202-12
Bushing, reducing, 1/4 x 3/8 in. NPT	1	X-202-30
Washer, lock, .146 ID x .53 in. OD	1	X-22-25
Washer, lock, .172 ID x .333 in. OD	2	X-22-7
Hose	1	X-386-102
Fitting, hose connector 90deg.	2	X-391-20
Clamp, hose, .25/.70 in.	2	X-426-9
Screw, slotted pan head machine	2	X-51-12
Coupling, non-metallic	1	X-567-1
Conduit, convoluted	1	X-6003-10
Nut, hex machine screw, 6-32	1	X-71-2

Description	Qty.	Part No.
Transfer Pump 120 V 60 Hz		**274781**
Coupling, conduit-elbow	1	156327
Coupling, conduit-elbow	1	156327
Fuse, 5 A, 250 V	1	239298
Relay, 120 VAC, 15 A	1	241950
Cover, conduit box	1	266469
Fuse holder, inline	1	269216
Box, junction	1	274883
Harness, wiring, motor	1	275558
Harness, wiring, engine, 125-180 kW	1	275559
Bracket, relay	1	279875
Box, controller	1	A-274818
Pump, motor assembly	1	A-290024
Bushing, reducing, 1/4 x 1/2 in. NPT	1	X-202-12
Bushing, reducing, 1/4 x 3/8 in. NPT	1	X-202-30
Washer, lock, .146 ID x .53 in. OD	1	X-22-25
Washer, lock, .172 ID x .333 in. OD	2	X-22-7
Hose	1	X-386-102
Fitting, hose connector 90deg.	2	X-391-20
Clamp, hose, .25/.70 in.	2	X-426-9
Screw, slotted pan head machine	2	X-51-12
Coupling, non-metallic	1	X-567-1
Conduit, convoluted	1	X-6003-10
Nut, hex machine screw, 6-32	1	X-71-2

Fuel Tank Kits, Day

Day Tank, 10 Gallon, Economy		**PA-274602**
Tank, day	1	274602
Motor, pump	1	352898
Pump	1	352899
Coupling, pump drive	1	352900
Sensor, float	1	354367
Switch	1	354417
Day Tank, 10 Gallon, Economy		**PA-274603**
Tank, day	1	274603
Motor, pump	1	352898
Pump	1	352899
Coupling, pump drive	1	352900
Sensor, float	1	354367
Pan, rupture basin	1	354369
Switch, basin	1	354370
Switch, float	1	354371
Switch	1	354417
Day Tank, 25 Gallon, Economy		**PA-274604**
Tank, day	1	274604
Motor, pump	1	352898
Pump	1	352899
Coupling, pump drive	1	352900
Switch	1	354417
Sensor, float	1	354418
Day Tank, 25 Gallon, Economy		**PA-274605**
Tank, day	1	274605
Motor, pump	1	352898
Pump	1	352899
Coupling, pump drive	1	352900
Switch, basin	1	354370
Switch, float	1	354371
Switch	1	354417
Sensor, float	1	354418
Pan, rupture basin	1	354419
Day Tank, 50 Gallon, Economy		**PA-274606**
Tank, day	1	274606
Sensor, float	1	352897
Motor, pump	1	352898
Pump	1	352899
Coupling, pump drive	1	352900
Switch	1	354417